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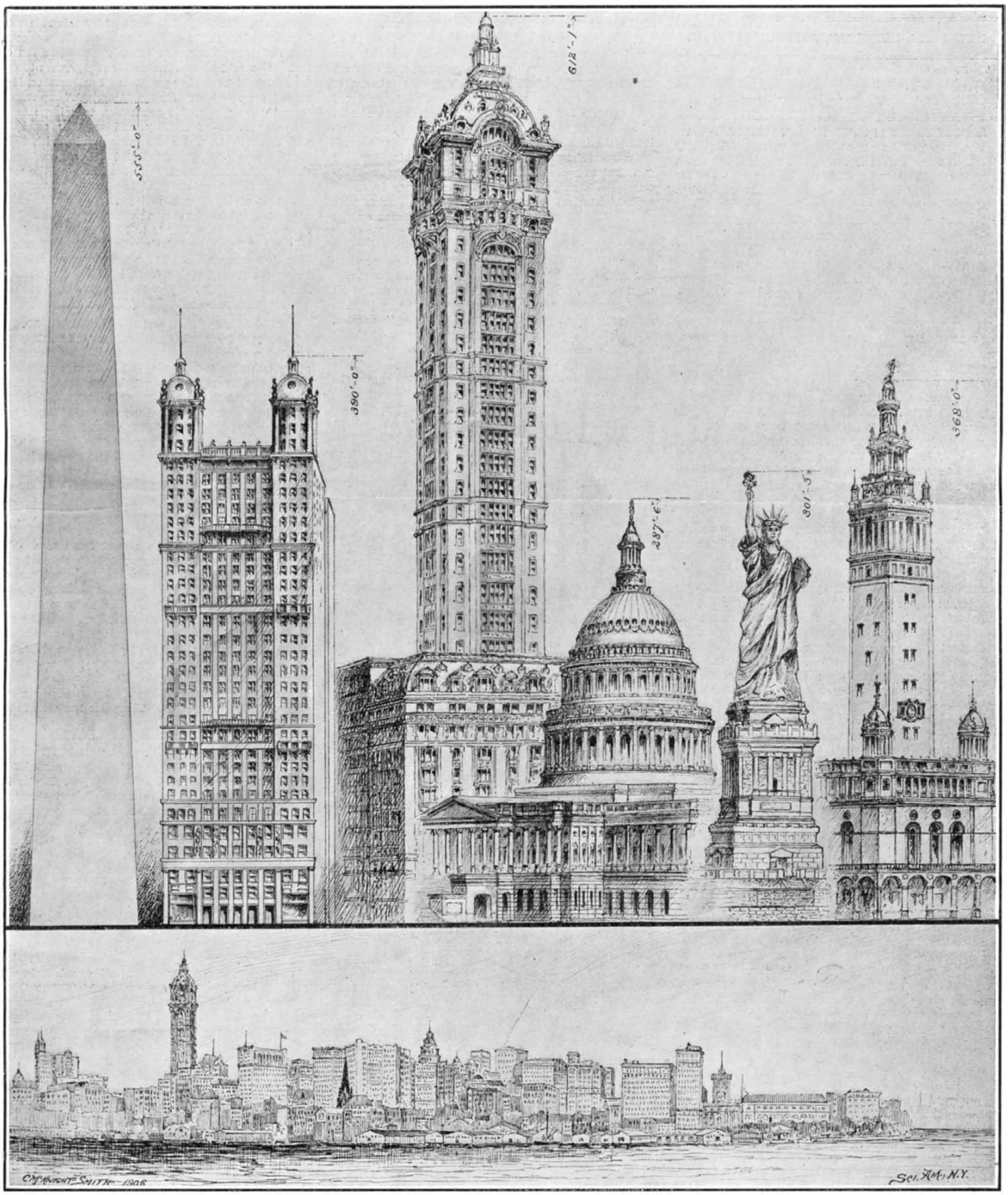

This Will Be the Loftiest Masonry Structure in the World. The Lower Engraving Shows How It Will Dominate the Tall Buildings of the Lower City.

AN OFFICE BUILDING 612 FEET IN HEIGHT, NOW UNDER CONSTRUCTION IN LOWER NEW YORK.—[See page 174.]

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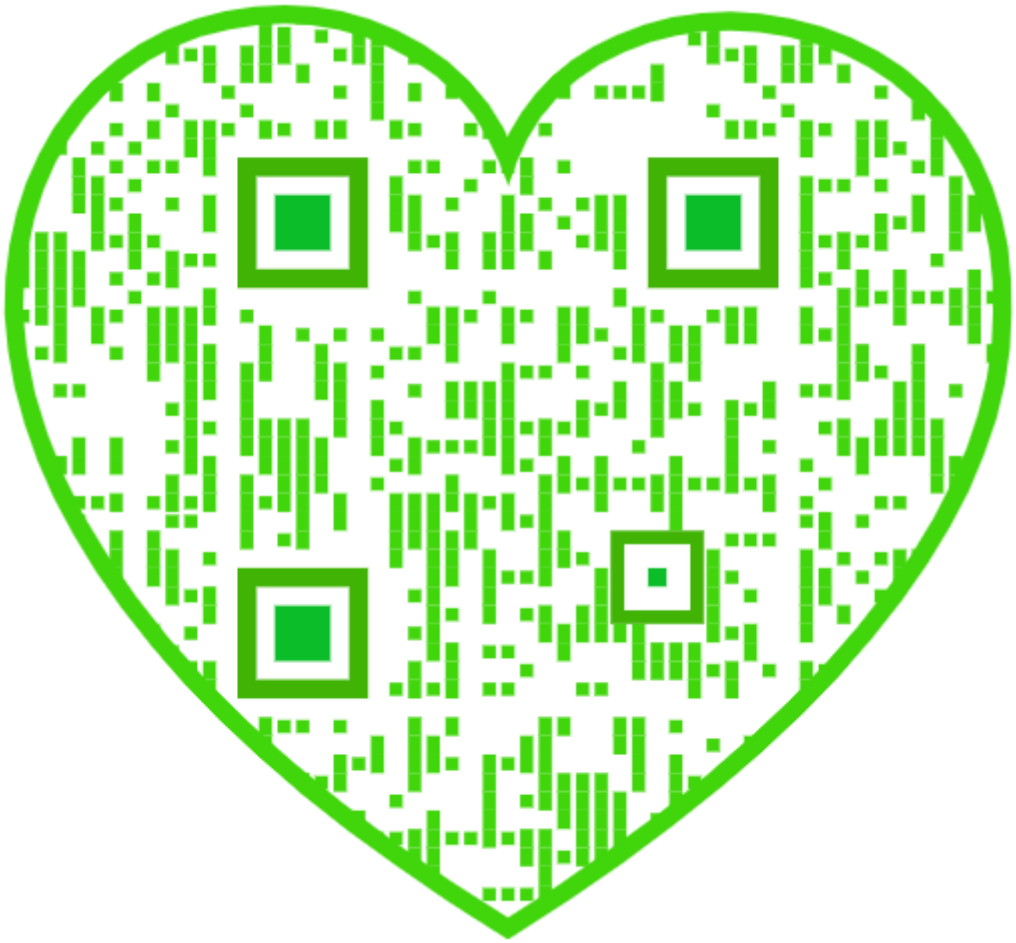

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, SEPTEMBER 8, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LACK OF PROGRESS ON THE MANHATTAN BRIDGE.

The people of the city of New York, and particularly those who live in the Borough of Brooklyn, are again growing anxious on account of the apparent further delay in the construction of the Manhattan Bridge. It is now nearly three months since the contract was let for the construction of the steelwork, yet, as far as any outward evidence goes, there is no sign of the erection of this part of the work. The piers upon which the towers are to be erected are to-day as barren of any ironwork as they were four years ago when they were first completed; and instead of the public being greeted with the sight of the steel towers growing steadily day by day on the base which has so long awaited them, all that they have been greeted with is a series of disquieting rumors in the daily press, to the effect that the contractors to whom the steel work was awarded have had difficulty in making arrangements with any big steel concern for the supply of material. Of this phase of the question, we know nothing, and it does not, indeed, properly concern this journal. But we do feel called upon to ask on behalf of the traveling public whether something cannot be done by the Mayor, or his deputy, to break up the deadlock, and get this greatly-needed public work once more moving toward its long-delayed completion.

The construction of the bridge was originally authorized as far back as December 30, 1899. The piers were commenced and completed within reasonable time during the administration of Mayor Van Wyck. When the new administration under Mayor Low took hold of the matter, it was considered that the plans for a cable suspension bridge were inadequate, and a suspension bridge of the eye-bar type was substituted. Then, the Board of Aldermen refused to make the necessary appropriations for construction, and the matter was entirely tied up during the administration of Mayor Low. Upon the accession of the present administration under Mayor McClellan, the former engineers who had charge of the work under Mayor Van Wyck were reappointed. They promptly threw out the eye-bar design and consumed two years' time in preparing plans for a bridge with wire cables. On this design bids were received in August, 1906. Immediately there followed a taxpayers' action, on the ground that the specifications were not legally drawn. The proposals were all rejected by the city, new specifications drawn, and proposals again asked for in April of the present year. But two taxpayers enjoined the opening and awarding of the contract, and this caused a further delay. When the court finally ordered the award of the contract, there was a further objection, this time made by the Bridge Department; for after an exhaustive investigation as to the ability of the various bidders, they advised in their report to the Board of Estimate and Apportionment that the contract should not be let to the lowest bidder, but to the lowest bidder but one, the Bridge Commissioner objecting to the irregularity shown by the lowest bidder in estimating the cost of items in the contract, and to serious informalities in the matter of the sureties on the proposal bond. The Board of Estimate, however, awarded the bid to the lowest bidder on the 14th of June last.

A serious feature in the present delay is the fact that the Brooklyn anchorage has been completed for several months to the point where the steelwork included in the contract is necessary, before the work can be carried up any higher. The steel not being forthcoming, the work on this anchorage has been stopped, with a possible liability on the part of the city to the contractor on account of the delay. Moreover, in the contract for the anchorages there is a clause which provides for the payment of a premium of $500 per day, if the anchorage is completed in advance of the contract time; and as the excellent progress made on the Brooklyn anchorage would have justified the contractors for that work in anticipating a handsome premium under this agreement, it would look as though the city might now be exposed to a further unnecessary drain upon its treasury on account of these exasperating delays.

WORLD'S RECORD FOR UNITED STATES ARMY GUN.

The series of tests which have been carried on during the past year at Sandy Hook of the Brown wire gun, which was manufactured for the United States army, have just been brought to a successful close; and the ballistic results obtained so greatly exceed anything that is officially on record in our own or any other army, that the incident calls for something more than passing notice. We have recorded during the course of the trials the unusually high velocities which were being obtained, velocities considerably in excess of those achieved with our own service guns. In the last ten rounds of the test, however, the charge of powder was increased from 73 pounds to as high as 84 pounds, with resulting powder pressures of from 48,672 pounds to the square inch to a maximum of 64,483 pounds per square inch. The velocities achieved rose steadily from 3,470 feet per second to a maximum of 3,740 feet per second, the muzzle energy corresponding to the last-named velocity being 10,295 foot-tons.

To appreciate the gain in power of this 50-caliber gun due to its great strength, which enables it to withstand the high powder pressures necessary to secure such high velocity, we have only to compare it with some other 50-caliber gun, such, for instance as the present service naval 6-inch gun, as mounted on our latest battleships and cruisers. This piece fires a 100-pound shell with a velocity of 2,900 feet per second and a resulting energy of 5,838 foot-tons at the muzzle. The weight of the wire-wound gun and of its shell are about the same as the service naval piece, and yet the energy is nearly 100 per cent greater. Although the powder pressures were so exceedingly high, the amount of erosion was not excessive, and the gun at the end of its severe test is said to be in good condition. There was some erosion near the powder chamber, but it was not sufficiently serious to appreciably affect the flight of the projectiles, none of them having been observed to "tumble." At such an enormous velocity as 3,740 feet per second, the trajectory is, of course, exceedingly flat, and evidence of this was shown in following the flight of the projectile, which, with 1½ degrees elevation only, did not strike the water until it was about 5,000 yards distant, and after the first ricochet the shell had traveled out of sight before it again struck the water, the officers in charge of the test not being able to observe the splash of the second ricochet, even when looking with glasses from the raised walk at the firing ground. The result is a great triumph for the wire-wound system of construction coupled with the peculiar inner tube of laminated plates, which constitutes the special feature of the Brown gun. The advantage of a system of ordnance capable of producing these high velocities, is that it enables the weight of the gun to be greatly reduced without the loss of penetrating power at given ranges.

THE NEXT CHALLENGER FOR "AMERICA'S" CUP.

The impression is gaining ground among yachtsmen that the next challenge for the "America's" cup will come from Germany, and should it be so, it cannot be denied that the interest in these contests will receive a decided stimulus and a greatly-needed flavor of novelty. The many contests which have been sailed during the past two decades by challenging yachts that flew the colors of one or other of the British clubs have served to demonstrate, particularly in the case of the last three or four races, that under the rules which at present govern these contests, it is a practical impossibility to design and build in Great Britain a yacht of sufficiently exaggerated form and sail area to compete against the best American production with any reasonable chance of success. So firmly is this idea settled in the minds of British yachtsmen, that it may be taken for granted that, if any challenge is sent under the present rule of measurement, the motive therefor must be found somewhere else than in any reasonable expectation of lifting the cup.

However, the Germans have made wonderful strides in the art of naval architecture as applied to vessels of the navy and the merchant marine; and we may feel certain that if they should challenge and send a yacht over, she would render a very creditable account of herself, and would be sufficiently formidable to render a series of races of the greatest interest. It is realized, of course, that German naval architects would labor under the great disadvantage of never having built a yacht of the type that would be required, and therefore, would not have at command that mass of constructional data derived from a long line of previous racing craft, which renders the position of such an able yacht designer as Mr. Herreshoff apparently unassailable. It is true that the Germans have done some good work in the design of smaller craft, and in the forthcoming races for the Roosevelt cup they have sent over some very able and exceedingly well-built 21-foot yachts as competitors. It is a far cry, however, from these "little fellows" to a modern racing 90-foot "single-sticker." Therefore, if the Germans should challenge, they would have to strike out into a practically new field, and they would be thrown upon their theoretical knowledge in the matters of design, selection of materials, and construction.

The case would be entirely changed, however, or very greatly modified, if the New York Yacht Club should do what the majority of yachtsmen, both here and abroad, very much hope that they will do, namely, permit the future contests for the "America's" cup to be sailed under their new rule of measurement—the rule under which the recent very successful race for the King's cup was sailed during the New York Yacht Club cruise. The advantages of such a step are twofold—first, that the yachts built under this rule would be at once less costly and more reasonable in construction and proportions, and second, that after the contest they would be serviceable for many years to come for racing and cruising purposes. Furthermore, if the new rule were adopted for the "America's" cup contests, it would unquestionably neutralize, to a large extent, the advantages of locality and weather conditions which constitute, under the present rule, with its encouragement of exaggerated and delicate racing machines, a decided advantage to the holder of the cup.

A challenging nation would no longer be under the necessity of building a racing machine with such a small margin of safety as to necessitate its being towed across the Atlantic if it is to be got over to this side at all, and because of the smaller cost and the better boat that was produced, there would undoubtedly be a larger number of yachts built both for the challenge and for the defense.

THE GREATEST GEM MINE IN THE WORLD.

The sapphire workings at Yogo Gulch, Montana, are being gradually developed into a great and permanent mining industry, says Mr. George F. Kunz in a forthcoming report on precious stones, published by the United States Geological Survey. Taken as a whole, the Yogo dike is perhaps the greatest gem mine in the world. It is about four miles long on the surface, and being a true igneous dike, descends to an indefinite depth. It is estimated that the entire content of workable sapphire-bearing rock would approximate 10,000,000 cubic yards. A mining plant is now being erected here which will quadruple the previous output and make Montana sapphire mining a very important factor in American gem production.

The stones obtained are not of large size. They range from "culls," used for watch jewels and other mechanical purposes, to gems averaging, when cut, from half a carat to 2 or 3 carats and rarely up to 5 or 6. As gems they are brilliant, free from flaws and of good color, ranging from light shades to the rich, deep blue of oriental sapphires. The Yogo crystals have an advantage for mechanical uses over East Indian stones in their form, which is largely short prismatic or rhombohedral with flat basal terminations, and hence they need much less cutting for such purposes as watch jewels. The gems are sent to Amsterdam for cutting.

ADULTERATION OF CEREAL BREAKFAST FOODS.

The cereal breakfast foods as a class, according to Dr. Charles D. Woods and Prof. Harry B. Snyder in a bulletin issued by the Department of Agriculture, are ordinarily free from adulteration. Various experiment station chemists and public analysts in States having pure-food laws have examined the brands on the market, as indeed they examine all classes of food at frequent intervals, and found that as a general rule they were made from good, sound grain without admixture of harmful substances. Some may be made from coarse milling products, such as wheat middlings, and some doubtless contain molasses, glucose, or other similar materials which do not appear in the manufacturer's description, but which are not injurious.

Occasionally the percentage of ash or mineral matter in breakfast foods is abnormally high, but this is apparently due to common salt added to give flavor and not as an adulterant. In general, it may be said that there is every reason to suppose that the manufacturers endeavor to use wholesome materials, and that if an impurity is occasionally found in their goods it is accidental rather than intentional. Furthermore, cereal breakfast foods, as previously noted, are generally made from well-cleaned grain and are marketed in a cleanly way. In the case of the package goods the form of marketing affords special protection while the goods are in the dealer's hands and also in the household, where they are very commonly kept in the original cardboard box or package.

The tensile strength of catgut musical-instrument strings is 60,000 pounds per square inch, the elongation at rupture 15 to 19 per cent.

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SEARCHING FOR THE REAL ORIGIN OF SPECIES.

The theory that the countless varieties of life on this earth have been developed from a common origin is almost as old as philosophy. It was the French zoologist Lamarck, however, who made the first intelligent effort to explain the real cause of this development. It was his claim that the development had been brought about by stress of circumstances; that changes of environment render certain characters unnecessary, and that they are lost through disuse, while on the other hand other characters are made necessary by the new conditions and these are, in time, acquired through use or exercise, thus producing a new species. For example, he claimed that snakes have lost their legs owing to disuse in crawling through narrow passages, while on the other hand, the giraffe has developed a long neck owing to scarcity of vegetation on which he could browse, and the fact that he has been obliged to reach up among the trees for his food.

While Lamarck observed that there is a constant struggle for existence, the importance of this fact escaped him and it devolved upon Darwin to develop the doctrine and demonstrate the part it has played in the evolution of the species. Darwin's doctrine may be briefly summarized as follows: No child is exactly like its parents; the difference may be very slight, but it is sure to be there. All life is at war, each individual struggling either to overpower, fight off, or avoid its enemies. So fierce is the struggle that on the average not more than one individual in a thousand lives to the full term of its life. It is the natural inference then that this one survivor possesses certain characteristics which peculiarly adapt him for the life struggle. The same is true of each generation, and according to Darwin's theory this natural selection of the best in each generation results in the development of a new species, a development depending on the very slight variations between child and parent and hence requiring thousands of generations for its accomplishment. Darwin also advanced the doctrine of sexual selection, which, in a manner similar to natural selection, chooses the best and strongest of each generation.

It is nearly fifty years since the doctrine of natural selection was first published, but until very recently no advance had been made over the work of Darwin. The interim was spent in discussing his theories and digesting the enormous mass of information gathered by that indefatigable investigator from all parts of the globe. Lately several persons have begun seriously to question Darwin's theory. A careful study of heredity has been made. The methods of the expert horticulturist and the fancier have been investigated with the result that the shadow of a serious doubt has been cast upon the ability of natural and sexual selection alone to evolve a new species. Contrary to the general supposition, fanciers do not develop a new strain by successively selecting and mating those individuals which show slight variations in the direction of the desired strain. On the contrary, every new breed has its origin in some exceptional individual of the flock or herd which the keen breeder has detected and either blended with the normal type or preserved intact by intelligent cross-breeding. This does not necessarily mean that natural selection may not, in thousands of generations, evolve a new species. Our lives are too short to prove or disprove the theory by actual experiment. We can say, however, that the work of expert breeders, affecting but a few generations, does not conform with the general principles laid down by Darwin. Darwin realized that the methods of fanciers and horticulturists afford a valuable index to the processes whereby new species are formed in nature. Unfortunately, breeders are very reluctant to divulge their methods, preferring to give the impression that the new breed was obtained only after a long period of careful selection and cross breeding. Darwin was thus given the impression that the methods of the breeders corroborated his theory of the origin of species. However, he did recognize the fact of an occasional unaccountable production of an exceptional individual or "sport," and he suspected that this might be the origin of a new species. Curiously enough, however, Darwin's friends were so enthusiastic in their support of natural selection and so convinced of its infallibility that they actually laughed him out of the idea of seriously pursuing the new line of investigation. It remained, therefore, for Hugo De Vries, the Dutch botanist, to develop the doctrine that new species find their origin in sports, or "mutants," and that evolution, instead of being a gradual development due to the accumulation of minute variations, is rather a series of jumps, or abrupt changes from parent to child. According to this theory of mutation, natural selection still plays a part in determining the fitness of the individual to survive and perpetuate itself, but it does not necessarily imply the destruction of the parent type, as does Darwin's theory of evolution by natural selection.

An important law, which throws light on the preservation of the new species after a mutant has sprung into existence, was discovered about forty years ago by an Austrian monk named Gregor Mendel. The law was deduced from experiments with common garden peas. Its importance was not appreciated at the time and was apparently lost until by a strange coincidence the law was separately rediscovered a few years ago by three scientists, one of them being De Vries.

Mendel's law holds that the individuality of characters cannot be lost by cross-breeding; that the hybrid contains the characters of both parents equally, and that though one characteristic may dominate and thus completely obscure the other, the latent or recessive character would reappear in the progeny of the hybrid. For example, if red and white peas are crossed, the hybrid offspring will show red flowers only; but if the hybrids are interbred, one out of every four will have white flowers, and of the remaining red peas, one will always breed red peas and the others will show their hybrid character by breeding white peas in the proportion of one to three in the succeeding generation. The offsprings thus vary according to a mathematical law. Red is certainly dominant over white, so that hybrids of the two are always red, but the plant evidently contains the latent or recessive white characteristic in the same quantity as the red. When the hybrid reds are interbred we have all the possible combinations of the two characters in the offspring, namely, red and red, red and white, white and red, and white and white. This will give us but one pure red, and one pure white with two red hybrids, which shows that a pure breed can be produced by cross-breeding and that the purity of the breed cannot be determined by its ancestors but rather by its children. To be sure, in nature we have crosses of individuals which vary in more than one characteristic and the results are very complex. But if the breeding were carried on through a sufficient number of generations, and the children were sufficiently numerous, they would doubtless show every conceivable combination of the parent characters. We must remember, however, that all characters are not subject to Mendel's law. Francis Galton, in 1899, discovered that certain characters in parents are blended in the children. Prof. W. E. Castle, of Harvard University, has crossed a rabbit having lop ears (which are long) with a rabbit having short, erect ears, and obtained rabbits with ears of medium length which were sometimes lopped and sometimes erect. By crossing the hybrids with the pure lop-eared rabbits, he obtained a generation of three-quarter lops, thus showing the blending character of the lop-eared condition. Prof. Castle has also carried on interesting experiments illustrating Mendel's law and has discovered that in guinea pigs a rough coat is dominant over a smooth coat, and a short one over a long or Angora coat; also that in the color of the coat, there is a definite order in which each type is dominant over the succeeding, and recessive to the preceding, types as follows: 1, Agouti, or black, tipped with yellow; 2, black; 3, yellow; 4, white. In man a condition of hypophalangia (two-jointed instead of three-jointed digits) is dominant over the normal condition. In mice the peculiar waltzing habit of so-called Japanese mice is a recessive character in heredity.

Mendel's and Galton's discoveries throw a flood of light upon the processes followed by nature in producing a new species from a mutant. However, the real origin of the species is not found in a mutant. We must go back a step further and find the origin of the mutant. Efforts toward this end are now being made, particularly with plants and with insects. It has been suspected that temperature changes and new environments might have something to do with the origin of species, and the experiment has been tried of breeding butterflies at various degrees of heat. Dr. M. Standfuss, of Zürich, has done some very extensive work along this line, producing arctic and tropical varieties as well as intermediate forms by raising the butterflies in heated or cooled boxes. It is claimed that butterflies thus reared are not fixed species and will not breed true. In one case, however, Standfuss has apparently succeeded in obtaining a fixed species by this treatment. The achievement is described in his own words as follows:

"After much trouble a sufficient number of butterflies could be obtained only from *Vanessa urticæ*. In this work 8,281 pupæ were used. It was difficult to obtain very abnormal females. Four large tubs and other vessels filled with luxuriant nettle bushes and a number of smaller pots containing carnations were placed in a small glass house exposed to the sun. Arrangements were made to shade the house whenever it seemed advisable to do so. On the 7th of June, 1897, the first abnormal *Vanessa urticæ* were placed in the house, followed up to the 15th of July by the remaining individuals, in all forty-two individuals—thirty-two males and ten females. Almost without exception the males were of the most extreme type, with wings completely black at the posterior portions. Of the females only two individuals were of this type; the remaining eight were fringed with blue and were partly spotted with reddish brown toward the rear extremity of the wings. It must be confessed that this was a very small number of females from 8,000 pupæ. . . .

"The 25th of June came, and still there was no evidence of any mating. But mating must have occurred, for on the 26th of June I found the first heap of eggs on the under side of a nettle leaf. In the following days eight females were laying eggs, among them the most abnormal in color.

"It was impossible to determine how many eggs a single female laid, because the eggs were deposited during several days on various leaves. There could hardly have been less than 200, because nearly 2,000 pupæ were developed, despite the fact that of the ten females two were killed prematurely by spiders. Among those which were brought to an untimely end was unfortunately the least aberrative of the two extreme types. It was possible that this specimen did not lay any eggs, for the ovaries were found very full. On July 2 caterpillars appeared. At first they were allowed to feed upon the nettle leaves; later they were transferred to well-ventilated breeding boxes. The offspring of the most abnormal female were kept separate. On July 12 the first pupæ appeared. In the meanwhile an infectious disease appeared among the butterflies and killed off all but the strongest. In all only 493 specimens developed to the pupæ stage because of this unfortunate circumstance. Even of this small quantity only a few were preserved because of a parasite which had entered the breeding boxes and could not very well be excluded. It is possible these parasites were introduced when the flowers were brought into the glass house. The descendants of the abnormal female in their turn yielded 52 pupæ. These are included in the figures previously given.

"On July 21 the butterflies appeared. One individual was as normal as another. The first offspring of the abnormal female were also normal. But on July 28 appeared another individual, which was considerably different from the normal type. On July 31 and August 1 two more aberrants appeared, although not extremely abnormal. On the 5th of August appeared, among the last butterflies resulting from these experiments, the individual shown in Fig. 5, plate 5 [of the original]. This, like the three previously mentioned, was descendent from the abnormal female and all were males. In my excitement I had to ask my assistant to kill the creature for me, for I feared that I would myself either crush it or permit it to escape.

"This last individual, which resembles the parent type most narrowly, still differs from the parent in so far as the blue spots of the outer edge of the wing project back from the edge and into the wing surface.

"Summarizing the results of these breeding experiments we have the following:

"1. Two of the ten females did not breed.

"2. The offspring, of which only a small fraction reached the imago form, and representing the descendants of 7 pairs, were all normal.

"3. An eighth pair, from which only 43 butterflies in all were obtained, bred 1 individual which differed markedly from the parent type and 3 other individuals which differed less markedly from the normal type.

"4. These 4 individuals were all males.

"5. Only the most abnormal female (the 32 males, so far as their abnormal characters were concerned, were practically equal) transferred its characteristics, more or less, to a small part of its descendants. From this it would seem to follow that heredity had something to do with abnormality.

"6. Inasmuch as most of the specimens were killed by disease or parasites, it is most necessary to conduct another series of experiments."

Dr. Standfuss's experiments have been repeated in this country by a Mr. Seifert, who has gone a step further and endeavored to produce variations in butterflies by means of chemical injections in the pupæ. The experiment was only partially successful, for the pupæ died, but some of them developed far enough to show that new markings had been induced by the chemical treatment.

Much more successful have been the experiments of Dr. D. T. Macdougal, director of the Department of Botanical Research of the Carnegie Institution. Dr. Macdougal has actually succeeded in producing a new species by injecting the ovary of the plant *Raimannia odorata* with various solutions. The solutions used were a ten per cent sugar solution, a solution of calcium nitrate, one part in a thousand to two thousand of water, and certain radium preparations. Among the progeny there appeared a number which were very different from the parent. These have bred true and furnish the first indisputable instances of a new species being produced by artificial agencies. "The characters of the newly-arisen form," said Dr. Macdougal, "were so strikingly aberrant as to need no skill in their detection. The parent was villous-hairy, the mutant entirely and absolutely glabrous. The leaves of the parent have an excessive linear growth on the marginal portions of the leaf blades, and hence become fluted. The excess of growth in the mutant lies

(*Continued on page 174.*)

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A MOTOR AMBULANCE FOR THE UNITED STATES ARMY.

BY WALDON FAWCETT.

A specially constructed automobile ambulance is the latest device of modern warfare which has engaged the attention of the War Department at Washington, and such has been the success attending the experiments thus far made with this new adjunct of the hospital service of the United States army that probably arrangements will be made in the near future for the adoption of such vehicles as a part of the regular equipment at our principal military posts. The cost of the auto ambulances will be less than $3,000 each, and taking into consideration cost of maintenance and service rendered, these cars possess many points of superiority over the four-mule ambulances heretofore employed.

While several European nations anticipated the United States government in the introduction of the motor ambulance for military service, the movement which led to the present innovation was really inaugurated over two years ago when Surgeon-General O'Reilly called the attention of the Secretary of War to the fact that practically no progress had been made since the civil war in the facilities for the transportation of the dead and wounded from the field of battle. With the sanction of the Secretary of War, orders were issued directing Capt. Clyde S. Ford, assistant surgeon, United States army, then stationed at Fort Barrancas, Florida, to make a thorough investigation of the transport problems of the hospital service—a subject to which he had previously devoted considerable attention. The recommendations of Capt. Ford were so emphatically in favor of motor ambulances as affording the ideal solution of many of the problems involved, that he was authorized to have an experimental car constructed in accordance with his own designs.

In view of the exactions likely to be placed upon an army ambulance, operating ofttimes under rather unusual conditions, Capt. Ford decided in favor of steam in preference to any other motive power, and the automobile was constructed under his direction by the White Sewing Machine Company, of Cleveland, Ohio. It is an 18-horse-power vehicle, and the chassis is practically of the stock type employed in the regulation touring car of the White model, but the body, which was designed by Capt. Ford, is of course unique in construction.

The top which surmounts the body is little higher than that of the ordinary inclosed automobile and is hung with heavy curtains upon which, as upon the body proper, appear the letters U. S. and the design of the Maltese cross in red upon a white ground, which constitutes the emblem of the medical branch of our military service. The interior of the car, under ordinary conditions, presents a clear space save for long seats on either side, the occupants of which face one another. This arrangement insures a maximum carrying capacity when the motor is used as an ordinary conveyance by officers of the medical department or is employed in the transportation of slightly wounded soldiers or convalescents.

In the event of the car's requirement for service as a hospital on wheels for the conveyance of seriously wounded men, a transformation is quickly effected by folding the seats, previously mentioned, snug against the wall on either side and letting down from the ceiling, where they have been suspended out of the way, heavy oak poles or standards which are set in place in the middle of the car, dividing the interior into two sections, as it were. The purpose of these poles, to which are secured iron hooks, is to serve as supports for the litters or stretchers to which the entire interior of the ambulance is given up under this arrangement.

The auto ambulance affords space for four stretchers with the occupants extended at full length. Two of the litters are placed side by side on the floor of the car while the other two are placed above in position corresponding to the upper berths of a sleeping car. Each of these upper litters is supported on the inner side by the hooks on the oak standards in the middle of the car, while on the opposite side it is suspended by leather straps attached to the framework of the top. At the rear of the car is a broad step for the ambulance surgeon, and the driver's seat at the front of the machine provides accommodations for two medical attendants in addition to the chauffeur.

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Interior of the New United States Automobile Ambulance.

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Carrying Wounded to New United States Army Automobile Ambulance.

The tests to which this initial American military automobile ambulance has recently been subjected at Fort Myer, Virginia, were designed to bring out all possible defects, but despite the severity of the tasks imposed, there were no developments that would make necessary radical changes in either design or construction. The automobile has been operated, under campaign conditions, over a total of more than 1,600 miles. In one test it carried a load of twelve persons a distance of fifteen miles in less than an hour and on another occasion a speed of nearly forty miles per hour was attained on a smooth road. The motor has more than met the expectations of the army officers in hill-climbing capabilities and has demonstrated an ability to travel over ploughed ground at a speed of six miles per hour.

The increased carrying capacity of automobile ambulances gives them great superiority over the old-style vehicles of this class, but of course the chief consideration in favor of their adoption is found in the higher speed which can be attained, obviously a most important factor, since in surgery saving of time frequently means the saving of life. In time of peace the auto-ambulance will be employed in the sphere of usefulness now open to its horse-drawn prototype, and in time of war such vehicles will be used to remove the sick and wounded from the field of battle to temporary hospitals or direct to railroad trains and also for the transfer of invalids from temporary hospitals to base hospitals.

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Placing Men on Stretchers in the New Automobile Ambulance.

VIEWS SHOWING NEW STEAM AUTOMOBILE AMBULANCE FOR THE UNITED STATES ARMY.

Artificial Caoutchouc.

At the rate at which the consumption of caoutchouc is going, the question arises if the production of this substance will much longer be sufficient for the needs of the multiple industries that use it. The annual production of caoutchouc varies at present between 60,000 and 70,000 tons, and in 1904 already the world's consumption reached 60,000 tons. On taking into consideration the progress of automobilism and the application of electricity (the extension of which is far from stopping), we may affirm that this year the consumption has exceeded the production. There will, therefore, soon be created a crisis, for which Mons. E. Coustet proposes three solutions.

The first would consist in utilizing the mineral caoutchouc or elastic fossil bitumen, discovered in 1785 in the mines of Castleton, England, and in 1816 n the environs of Angers, France. The second would be the employment of an artificial product possessing properties analogous to those of the natural product. This product exists; it was obtained in 1846 by the chemists Sacc and Jonas, by treating linseed oil with azotic acid. An elastic and membranous substance is then obtained, the "*caoutchouc des huiles*" (oil-caoutchouc), which has already been utilized to render fabrics impervious. Similarly, artificial caoutchoucs have been obtained by treating tar or the oil of turpentine with sulphuric acid. These products did not have great success at their appearance; but then the dearth of caoutchouc was not in question, and it is very probable that the need would soon call forth improvements that would bring the manufacture of artificial caoutchouc to the desired point. The third solution would evidently be to increase the natural product, but it is not perhaps the quickest.—From L'Illustration.

Here is an instance showing that obedience to the whittling conscience is still a cause of inventions. Mr. H. S. Hopper was driving through one of the Southern swamps some time ago, when he cut down a reed which he used for a whip. It followed, of course, that he cut off a chip from the reed and used it for a toothpick. He noticed that the chip was hard and durable and yet pliable, and for the purpose was much better than the article commonly on sale. Acting on the suggestion, he has designed an automatic machine, which makes an excellent grade of toothpicks from the reeds of the Southern swamp. A factory has been built at Bower's Hill, Norfolk County, Virginia, and the business inaugurated. A reed is cut into suitable lengths without knots, and a set of radial knives is made to split the tubular reed into pieces the size of a toothpick. Before splitting, the ends of the tubular sections of the reed are reamed out by tapering reamers, which remove the pith or soft interior, so that the splitting forms toothpicks with tapering ends of hard, tough material.

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SANITATION OF THE CITY OF WASHINGTON.—II.

BY BEN. WINSLOW.

THE SEWAGE DISPOSAL SYSTEM.

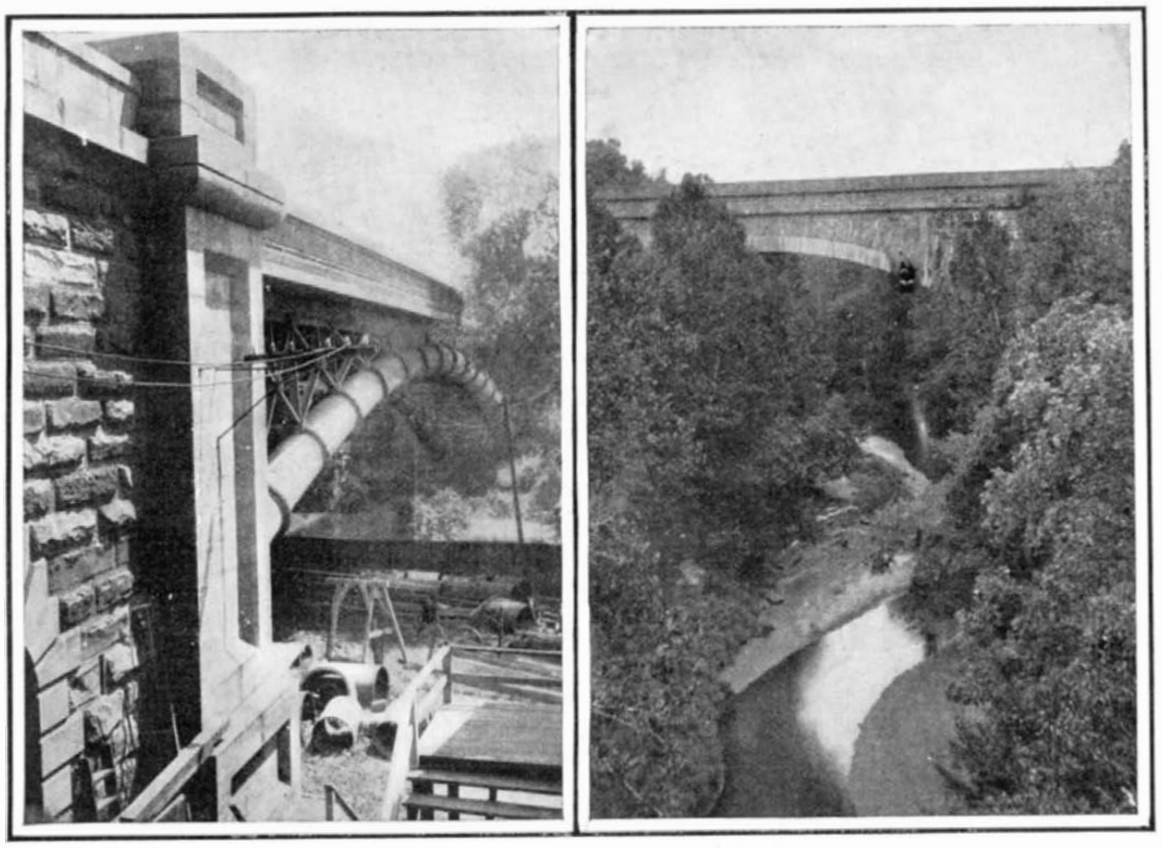
The Washington filtration plant, while of inestimable value in the national capital's fight against a high death rate, was not the first important movement in the campaign. For fifteen years or more the District engineers have been at work on the great sewage disposal system, which it is hoped will be completed next year. Plans for the filtration plant were not considered until several years after work had begun on the sewage system, but, being a smaller "job," it was completed in a comparatively short time.

In 1889 Congress, after going over volumes of figures showing that the high death rate in Washington was due in a measure to the lack of proper sewage facilities, authorized President Harrison to "appoint a board of sanitary engineers to report on the existing system of sewage, and to make recommendations for the extension of the system." The report was made the next year, and work on the recommended plan was commenced shortly afterward. As a result, Washington will have one of the best sewage-disposal systems in the world.

The recommendation of the sanitary board was that all the sewage of the entire city be collected at one point, and then forced across the Eastern Branch of the Potomac River to an outfall sewer, which discharges into the Potomac, several miles below the city. The cost of this project will be $5,000,000. The vital part of this great system is the pumping station—the point of collection—where the entire sewage of the city is raised a distance of nearly thirty feet and forced across the river. For the purpose of collecting the sewage two separate and distinct sewer systems are necessary, one at the usual level and one for the low-area district. The business section of the city, on Pennsylvania Avenue between the White House and the Capitol, is in the low-area district, and on several occasions this section has been flooded by water backing up in the sewers. The most notable flood in the history of Washington occurred in June, 1889, when rowboats were used to navigate the streets in this section. While later freshets were not so severe, cellars are frequently flooded and much damage results.

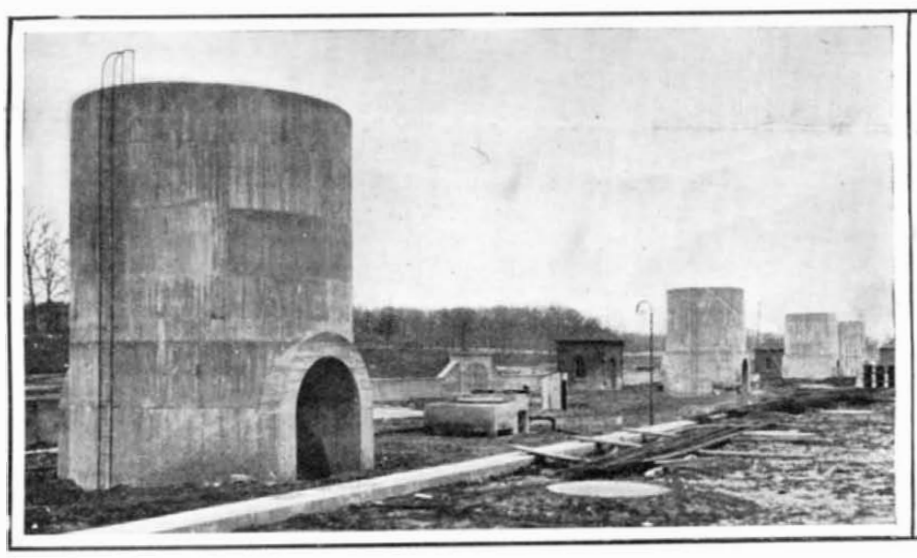
The first system of sewers has as its main feature a great trunk sewer, known as the B Street sewer, varying in diameter from seven to eighteen feet and extending a distance of over two miles. This trunk sewer is fed by numerous high-level interceptors and small conduits. The other system, which collects the sewage from the low-area district, consists of a large trunk sewer running under Pennsylvania Avenue, which is also fed by numerous interceptors and small conduits.

Ordinarily, the sewage from the B Street trunk sewer will flow into a junction chamber in the northeast corner of the pumping station. Here it will be divided by means of gates, and made to flow around a large sedimentation chamber into a screen chamber. In this chamber all the solids will be removed, and the liquid sewage will

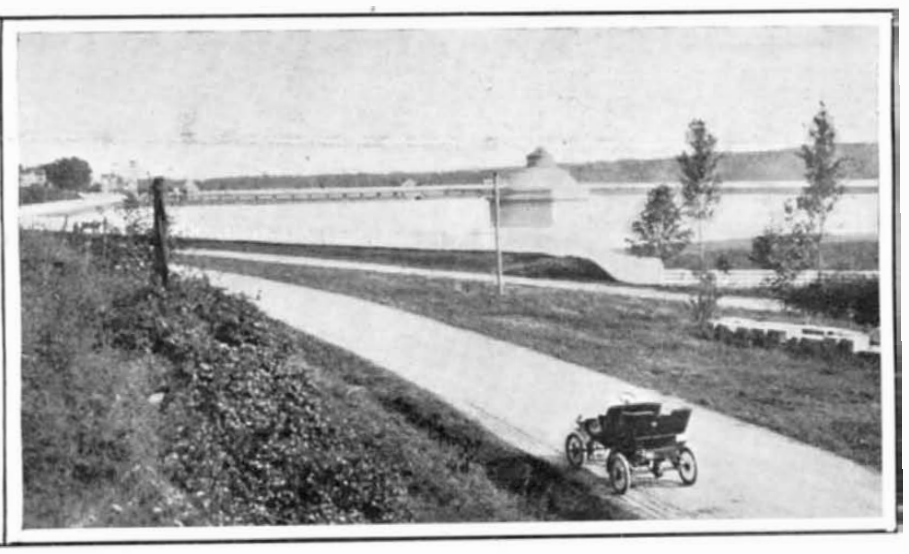


Pennsylvania Avenue Bridge. Cabin John Bridge.

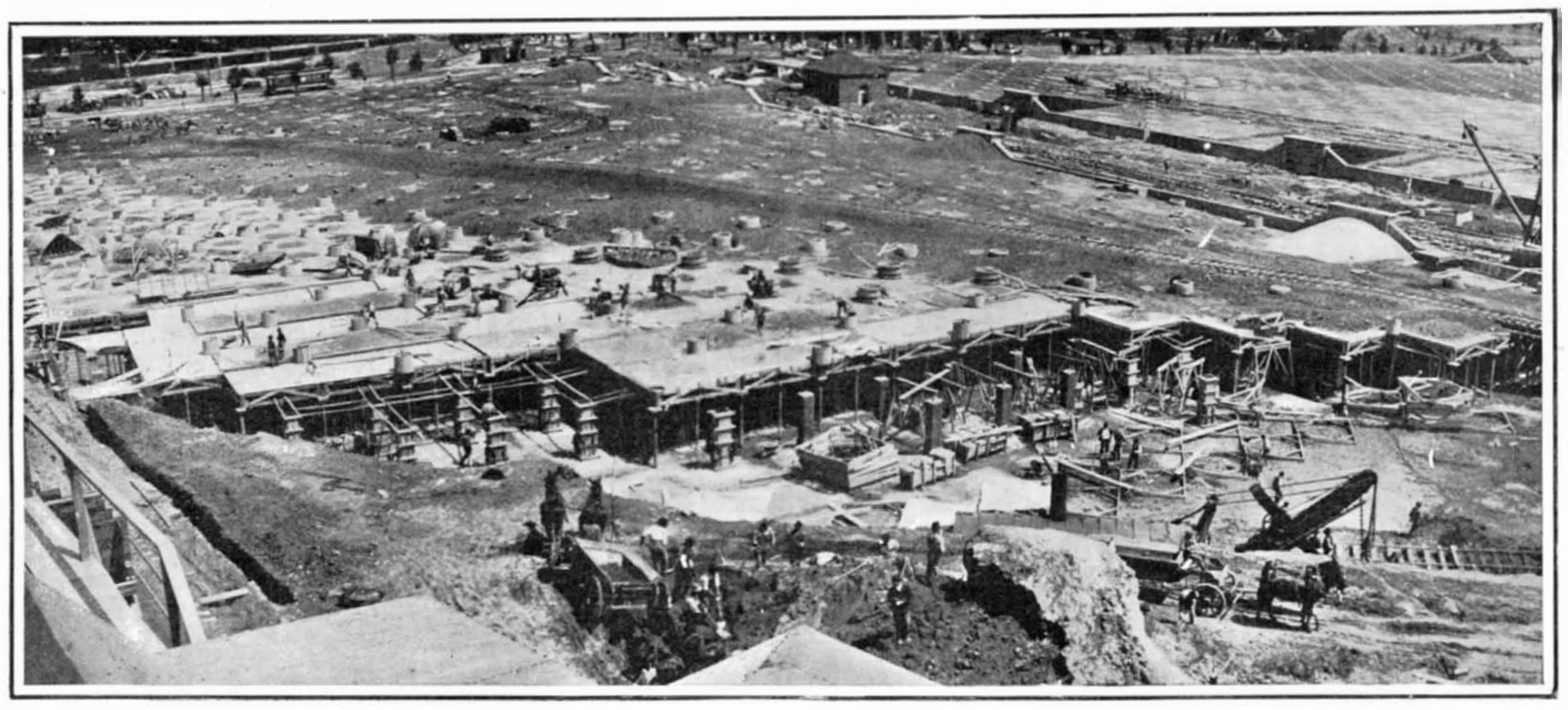
The Washington Aqueduct.



The Sand Reservoirs of the Filtration Plant.



Georgetown Reservoir and a Section of the Conduit Road.



A Panoramic View, Showing Each Stage of the Work.

SANITATION OF THE CITY OF WASHINGTON.—II.

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flow direct to the immense pumps which lift it into the siphon chamber. Here gigantic centrifugal pumps will force the sewage across the river through a pair of inverted siphons to the outfall sewer, through which it will flow by gravity to the outlet several miles down the river.

During heavy rainstorms, the gates of the sedimentation chamber will be opened, and the sewage will flow direct into this chamber instead of passing around it to the pumps. In this chamber sticks, sand, etc., will be removed before the sewage passes into the screening room and into the pumps. Should the rainfall prove exceptionally heavy, the storm water carried down in the large sewers will be divided by means of gates, which operate automatically, into four storm-water tunnels on the east and west sides of the pumping station. Through these tunnels the water not handled by the pumps will flow by gravity into the Eastern Branch. As a further precaution against flooding of the low-area district, immense storm-water pumps will be installed, and at the slightest indication of a flood, these pumps will be set to work pumping the storm water out into the river.

The solids removed from the sewage in the screening chamber will be pressed in hydraulic presses and loaded into a train of large buckets. These buckets, which are operated by electricity, run on overhead tracks, and carry their load through a conveyor tunnel extending around the east and west sides and across the north end of the pumping station, to a crematory.

The floor of the pump room is about twenty-five feet below the bottom of the river. In this room there will be thirteen powerful centrifugal pumps. Eight pumps on the west side, each having a capacity of 65,000,000 gallons a day, will be used for pumping storm water. The ordinary sewage from the high-level trunk sewers will be pumped by three pumps, each having a capacity of 65,000,000 gallons a day, while two pumps, each having a capacity of 20,000,000 gallons a day, will pump the sewage from the low-level system. The system has been designed to adequately handle the sewage of a city of 800,000 persons. All the sluice gates, valves, covers, and interceptor gates in the entire system, some of which weigh several tons and all of which are operated by hydraulic lifts, will be controlled by one man in the engine room, whether they are located in the station or a mile away.

The most interesting feature in the construction of this great system was that of laying the twin siphons across the river. Each of these siphons is five feet in diameter and 1,200 feet long. Most of the work was done under water by divers. The siphons were laid in forty-eight-foot sections, four twelve-foot sections being welded together on the pumping-station dock. Each forty-eight-foot section was fastened securely to the top of a fifty-foot caisson, simply an air-tight wooden box, and the caisson was towed into position and tipped over, so that the section of pipe floated under it. Ports in the caisson were then opened, allowing water to flow in, and gradually the caisson with its load of pipe settled to the bottom, where divers guided the section into place and secured it there. One twelve-foot section weighs 14,000 pounds, and the weight of the four sections handled by the divers is about thirteen tons. The siphons are laid on beds of piles driven in the bottom of the river, which has been dredged to the proper depth. From the siphon chamber the pipes go down with a steep slope to a distance of twenty-six feet below the surface of the water, and then rise an equal distance to the other side, where they connect with the outfall sewer in Maryland.

When this immense sewage-disposal system is put in operation in the spring of 1907, the most important work in the sanitation of Washington will have been completed, and the citizens who have been foremost in the enterprise can bend their efforts to the solution of the next important question—the sanitary housing of the poor of the national capital.

AN OFFICE BUILDING 612 FEET TALL—THE LOFTIEST MASONRY STRUCTURE IN THE WORLD.

When the tall office building, in the course of its rapid evolution, had attained the height of 300 feet, it was freely predicted that the limit had been reached, and that future structures in New York city would be of more reasonable vertical dimensions. That prediction was made not much more than a decade ago; and yet to-day there is in course of construction in lower New York a building whose summit will reach heavenward for over twice three hundred feet. The new building, which will be in the form of a tower and will constitute part of an extension of the present Singer building at the corner of Liberty Street and Broadway, will contain forty-one stories, and the top of its cupola will be 612 feet above street level. Not only will the Singer tower be the loftiest inhabited building in the world, but it will exceed in vertical height the famous Washington Monument on the bank of the Potomac, which, with its total height of 555 feet, is at present the tallest masonry structure erected by man. Although the Singer tower will lack some 300 feet of equaling the famous Eiffel Tower, it will be a far more difficult and costly structure to erect, and because of its narrow base will involve more complicated and serious engineering problems.

The new building will form the most important part of an extensive reconstruction of the old Singer building at the corner of Liberty Street and Broadway. Great credit is due to Mr. Ernest Flagg for his successful treatment of this unusual architectural problem and to his engineers for the solution of the constructional difficulties involved in the design of so narrow and lofty a building. An addition to the old structure, with a frontage of 76 feet on Broadway, is to be built on the northern side of the building, and the westerly portion of this addition will constitute the great tower. The original building and the addition will be fourteen stories in height, and the tower will extend twenty-seven stories above this.

Although in plan the tower will measure only 65 feet square, its total uplift is so great that its floor space added to that of the main building will be greater, with a single exception, than that of any other building in New York city, the total area amounting to 9½ acres. The elevator well will be oblong in plan and placed in the center of the building. For the service of the lower portion of the building there will be sixteen elevators, and, as the upper floors are reached, they will decrease in number, until there will remain four elevators for the service of the topmost floors. It is estimated that when the building is fully occupied it will accommodate about 6,000 people.

From a constructional point of view, the most interesting feature of this extraordinary structure is the means adopted in framing the steel skeleton, so that it will resist the enormous accumulated wind pressure, when the thunder squalls of the summer and the heavy gales of the winter sweep over Manhattan. Decidedly interesting also is the method of treatment which has given this tower an architectural character usually absent from our modern "skyscraper." The plan adopted, both in designing the steel skeleton and in the treatment of the exterior, has harmonized both the engineering and architectural requirements of the case. It was realized that, in order to obtain sufficient strength to resist the enormous transverse bending stresses due to wind pressure, it would be necessary to introduce diagonal wind bracing, and give to the tower a true truss form from foundation to top story. It was, of course, impossible to run continuous diagonal truss members clear across the building from wall to wall, because such an arrangement would have interfered with the windows. It was determined, therefore, to consider the structure as being built up of four square corner towers and a central tower consisting of the elevator well, with wind bracing running through each wall of each tower continuously, from base to summit, the five towers being tied together in lateral planes at the various floors. The corner towers are 12 feet square in plan, center to center of the columns. This provides an open space 36 feet in width, down the center of each face of the building, which is entirely free from diagonal bracing. These spaces are occupied by large bays filled in with glass, as shown in our perspective drawing. The lighting of the corner towers is by single windows, which are so disposed as to permit the diagonal wind bracing to be carried continuously throughout the whole height of the tower, without interfering with the lights.

Of course, this method of bracing resulted in very high stresses in the chords of the trusses, which in this case are the vertical columns of the tower, and these columns are of exceedingly heavy construction. The wind pressure was assumed at 30 pounds per square foot, uniformly distributed over the whole face of the building, and the total overturning moment of the wind reaches the enormous amount of 128,000 foot-tons. The total weight of the tower alone is about 23,000 tons; and yet so great is the wind pressure that on the windward side of the building, should a storm ever blow upon it with sufficient velocity to produce an average pressure of 30 pounds per square foot, the building would tend to lift, the total uplift on a single column amounting to 470 tons. In order to provide against this, the columns are anchored to the caissons, the margin of safety against lifting amounting to never less than 50 tons on the column. The figures for the loading on a single one of the columns will be of interest: The total dead load at the foot of the column in question will be 289.2 tons, this amount representing the weight of the steelwork and masonry. To this must be added 60 per cent of the maximum live load, under which is included furniture, fittings, and the maximum crowd of occupants. This reaches, at the foot of the column in question, a total of 131.6 tons, making a total dead and live load of 420.8 tons. The downward pressure on the leeward side of the building, due to the wind pressure, is 758.8 tons, which, added to 420.8 tons, gives a total load on the column of 1,179.6 tons. The greatest combined load on a single column is 1,585 tons.

The effect of this stupendous structure upon the already remarkable sky line of New York city will be to dwarf the immensity of surrounding buildings and deceive the eye as to their already lofty altitude. This will be particularly true of the stranger who visits New York for the first time, for he will find it difficult to realize that the towering skyscrapers which are dominated so completely by this tower are many of them between three and four hundred feet in height. The question of the future vertical increase in the dimensions of buildings will depend upon the financial success of the Singer Building. Should it prove possible to realize an adequate return upon an investment of this kind, it is not unlikely that corporations with whom the advertisement that is given by a spectacular structure of this kind counts for something will, in future years, attempt to rival or surpass it.

It is the confident expectation of the engineers that in spite of the great height there will be no perceptible sway in the Singer Building even in the heaviest storm.

SEARCHING FOR THE REAL ORIGIN OF SPECIES.

(*Continued from page 171.*)

along the midrib and the margins become revolute. The leaves are widely different in width, those of the mutant being much narrower. The parental type is of a marked biennial habit and near the close of the season the internodes formed are extremely short, which has the result of forming a dense rosette; the mutant forms no rosette, by reason of the fact that the stem does not cease, or diminish its rate of elongation, and hence presents an elongated leafy stem which continues to enlarge as if perennial."

The common evening primrose has also been treated by Dr. Macdougal with a solution of zinc sulphate and one individual produced which differed materially from the parent. Of course, this might be a mutant produced by natural causes and not induced by the chemical treatment, though the probabilities are against such a condition. In nature, ovaries of plants might be affected, Dr. Macdougal believes, either by the action of gaseous emanations, by radio-action, by the introduction of foreign pollen, or by the stings and incisions of insects.

Dr. Macdougal has also tried the effect of raising plants at various altitudes above sea level, and while markedly variant types have been produced, he has so far been unable to fix the new types; for when the plants were returned to their original habitat, they reverted to the normal type. At present Dr. Macdougal is breeding plants at New York, Jamaica, and the desert laboratory in Arizona, at sea level, and at altitudes of 2,300, 5,000, 6,000, and 8,000 feet. The experiment will cover a number of years, possibly a decade, to see if in that time any of the new characters induced by the change of environment will remain fixed or not.

The search for the real origin of the species is now on in earnest. Apparently we are at present on the right track, but even if the search is not ultimately successful it is sure to give us a much clearer insight into some of the most mysterious secrets of nature.

Illiteracy in the City and Country.

In the matter of illiteracy among children the cities make a much better showing than the rural districts. The line between city and country cannot, however, be very accurately drawn, because cities with less than 25,000 inhabitants are not, for the purposes of this study, separable from the distinctively rural areas. Accordingly the area which, for convenience, is designated as country includes many of these smaller cities. In the country as thus defined the illiteracy among children is 88.7; in the city, using this term to designate collectively cities of over 25,000 inhabitants, it is only 10.4. The contrast is least in the North Atlantic States, where the so-called country includes many large towns or cities under 25,000 in which the school systems are by no means inferior to those in the large cities. In this section of the United States child illiteracy in the city is 7.8 and in the country 10.8. In the South the difference is very marked; in the South Atlantic division, 32.4 and 193.4 for city and country, respectively, and in the South Central, 44.9 and 181.3.

The greater illiteracy in the country does not necessarily indicate that the regard for education is less there than in the city. One cause of the difference is the difficulty of providing school facilities for a scattered country population. The development of the school transportation system, already inaugurated in many country communities, will tend to remove this disadvantage. Another circumstance also operating to the disadvantage of the country population is their smaller per capita wealth, which necessitates a smaller per capita local appropriation for school purposes. Realizing that a certain amount of public instruction is indispensable for the general good of the State legislatures in many States have imposed a State school tax. This system, by which the wealthier school districts are made to assist the poorer, will naturally tend to lessen the difference between city and country in the matter of illiteracy.

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Correspondence.

The Dangers of Methyl Alcohol.

To the Editor of the SCIENTIFIC AMERICAN:

In view of certain literature which is being sent out by manufacturers of methyl alcohol, setting forth arguments in favor of its use, and claiming it to be non-injurious to the human being, except when taken internally, does it not seem criminal that such statements should be allowed to go out and mislead the laity?

A number of well-authenticated cases have been recorded from time to time, of persons who have lost their eye-sight from the mere inhaling of the vapors of wood alcohol, as well as from its use externally in liniments. Painters are specially subjected to the dangerous effects of this poison, and some of the cases referred to were those engaged in using shellac varnish, who had by continued absorption impaired their eye-sight and finally become totally blind.

One concern has quite recently mailed the writer a pamphlet entitled, "What Every Pharmacist Should Know About Methyl Alcohol." One of the "things" they should know is captioned on the margin "The Real Cause of the Trouble," and reads thus: "Methyl alcohol when taken internally does not act as a primary poison; the digestive juices decompose it within the body and change it into formic acid, which is the poison that causes blindness and death." The fact that it is poisonous is not in any way controverted by such logic as this! Would it not be a good plan if this firm could arrange to have the human being so constructed as to prevent this undesirable condition from existing further; have it so that the digestive juices would not be guilty of converting methyl alcohol into formic acid. Their product would then no doubt come into great demand as a beverage.

That methyl alcohol is poisonous externally as well as internally is no longer a debatable subject, and too much publicity of the facts cannot be given, especially in view of the fact that denatured spirit will soon be a reality, and presumably denatured with methyl alcohol, imparting its poisonous principles to the new commodity.

The chemists of the country are gradually coming to realize the full import of the wood alcohol makers' advertising campaigns, and the possibilities which may ensue if these said advertisers are allowed to go ahead unnoticed.

From a purely human standpoint, I hope that the SCIENTIFIC AMERICAN will not fail to use its influence to the end that more publicity of the facts shall be given from this time on, for there is no doubt that much harm will come from circulars of the kind above referred to, if the truth is not known by those who read them. D. STRODE JEFFERIS, Ph.G.

Philadelphia, Pa., August 9, 1906.

Aeronautic Terminology.

To the Editor of the SCIENTIFIC AMERICAN:

Owing to the wide circulation of the SCIENTIFIC AMERICAN and its consequent power for good in the interests of science and truth, the writer is prompted to call your attention to an error which crept into a column of the correspondence page of your issue of August 18, under the heading "Aeronautic Notes," and request that this correction be given publicity, for the purpose of righting what would otherwise create a wrong impression in the minds of your many readers who would doubtless appreciate being informed of the facts regarding the subject in question.

The error occurs wherein your correspondent states that a French aeronautic commission defined "aerostat" as being a "balloon *or airship* using a gas bag."

In the year 1889 (*not* a French commission, but) an international aeronautic congress was held at Paris. This congress composed an aeronautic phraseology, so to speak, intended to become universal. Among others established were three terms or classifications covering every known aeronautic apparatus.

"Aerostat," being one of these classifications, applies merely to the ordinary balloon.

The congress coined another term—"aeronat;" this applies to a dirigible balloon or airship.

Your correspondent was correct in his use of the third term, "aeronef," under which he grouped the helicopter, aeroplane, and orthopter; the definition of "aeronef" being: A purely mechanical flying machine, or aeronautic apparatus heavier than air.

In concise form, the classifications and their definitions, as established by the International Aeronautic Congress in 1889, are as follows:

Aeronef—Flying-machine.

Aerostat—Balloon.

Aeronat—Dirigible balloon (airship).

These terms have been generally adopted in Europe, and, it is to be hoped, will soon obtain in this country. As it is, we find our daily papers referring to a balloon as an airship; the latter term is also frequently applied to aeroplanes and other "aeronefs," and the term flying-machine is often applied to all classes of aeronautic apparatus indiscriminately.

The writer is trying, in so far as his limitations permit, to popularize the science of aeronautics, and, for the purpose of lucidity in writing and conveying one's idea with the certainty of being understood, hopes that such popular and influential papers as the SCIENTIFIC AMERICAN will adopt the classifications as specified, when speaking of aeronautic apparatus. The writer believes if this were done they would be widely quoted, and the great American press would take example, to the end that the general public would soon become acquainted with and retain the knowledge of the terms in question and what they define.

JOS. A. BLONDIN,
Member the Aero Club of America.

Albuquerque, N. M., August 20, 1906.

The Vacuum Process of Preserving.

To the Editor of the SCIENTIFIC AMERICAN:

For the past few years we have been interested in the pure food proposition, and have been working out various things that would help in this field from our end of the line. We have been working to get a perfectly sanitary package and seal to displace tin cans and jars, that are unsanitary for a number of reasons.

The old-fashioned Mason fruit jars have been a large factor in household canning, and there is no jar made and used to-day so difficult to seal and so unclean. A great number of these jars are used year after year, and in the course of time the fruit juices and particles of fruit work up behind the porcelain liners, and in time become very unpleasant. This can be ascertained by removing the liner from a cap that has been in use two or three times.

Packages covered with tin caps are dangerous because the tin is affected by the contents of the jar, particularly when products containing a large amount of acid are preserved. Also in jars where rubber is used, the contents are often tainted with the rubber. The list of objectionable features is almost unlimited when discussing old methods of sealing food products.

We want to put packages on the market that are not only sanitary in all particulars, but are perfectly pure and impervious to the action of any acids or alkalies found in food products. We have been able to secure this result, but in developing this seal we have found that the old method of sealing jars or tumblers does not answer in all cases, and have come to the conclusion that the only method of handling certain products so that they will conform to the pure food laws is to seal them under vacuum.

We have been more or less in touch with the vacuum canning business as it is handled to-day for the past ten years, but until we began experimenting ourselves, never took an active interest in it. Naturally being a new subject to us, after seeing how the process was handled and hearing what people said they got, we began to ask questions, and the more we asked the less we found out, and were forced to the conclusion that the people who were using this process did not really know what they got or why they got it, and could not tell us the effect a vacuum had on products.

We were also told that the amount of vacuum secured in a receptacle, hermetically sealed, depended on the condition of the atmosphere, and that it was only possible to get a vacuum of within 1 inch to 2 inches of mercurial barometer reading. In our own experiments we demonstrated that this was false, as we secured a vacuum greater than number of inches shown on barometer, and proved to our own satisfaction that there was no direct connection between the two.

We tried various vacuum pumps and machines and were not satisfied with them, and went to work to build some of our own and use our own ideas, with the result that we have been able to get within 0.3 inch of perfect vacuum as it is spoken of; 30 inches has been considered this perfect vacuum, and we have secured 29.7 inches.

Our experiments have brought a number of things up for discussion, and we have been unable to answer our own questions, and cannot find any books that will enlighten us, or get any satisfactory information from doctors, university professors, or bacteriologists.

We are, therefore, taking the liberty of writing you, and submitting a list of questions we would like to get answers to, in order to enable us to go on with our work.

QUESTIONS ON VACUUM PROCESS.

1. Are anaerobic bacteria common in fruits and general food products commonly put up by packers?

2. What vacuum pressure will destroy them, and is a high pressure more effective than a low one?

3. If vacuum alone will not destroy these germs, what degree of heat, and how long applied, will be necessary if sterilized in the open air, and what if in vacuum?

4. If food products are sterilized and put in a sterilized jar in which a vacuum is created, is it necessary to sterilize the jar and contents after the vacuum is made? If so, what is the lowest temperature Fahr. that will do the work?

5. Is there enough oxygen or air in a jar sealed under vacuum within 2 inches of a perfect vacuum to preserve life in aerobic germs?

6. If anaerobic germs do not require oxygen, would they thrive in the same vacuum?

7. What is the source of life to these germs? Do they require nitrogen to live, or what furnishes them with life outside of what they eat or absorb?

8. What class of germs exist in bacon, beef, ham, tongue, fish, tomatoes, peas, beans, corn, catsup, cane syrup, and sorghum?

9. If any of the above goods are put under vacuum to within one to one and one-half inches of perfect vacuum, what germs or percentage of germs will be destroyed, and what further operation, if any, will be required to kill the balance, provided of course that all of the above articles have been cooked or cured before sealing under vacuum, meats to be sealed cold and vegetables hot?

10. When the statement is made that water boils at 85 to 90 deg. Fahr. when sealed under vacuum, are we to understand that where it is boiled in the open air at 212 deg. Fahr. (which heat is supposed to kill all germs) the same result is obtained by cooking at 90 deg. Fahr. under vacuum?

11. Also if it requires say two hours' solid boiling at 212 deg. Fahr. of some fruits or vegetables to kill all germ life, how long and at what temperature will it be necessary to cook the same article under vacuum?

12. What is an absolute vacuum, and is it possible, with a sufficiently large pump or any pump used commercially, to secure a perfect vacuum? Why?

13. In your opinion what is the greatest degree of vacuum possible to be obtained, and why?

14. What would be the result to or condition of goods sealed if it were possible to obtain a perfect vacuum?

15. Is it possible to seal raw fruits, meats, or vegetables under vacuum and preserve them in perfect condition, in other words, keep them from decomposing or fermenting without sterilizing, and at what vacuum pressure?

16. Is germ life destroyed by vacuum, or is its action simply suspended?

17. If anaerobic germs are not killed by vacuum, what keeps them alive? Is enough gas or life-giving matter obtained from the decomposition of aerobic germs in foods sealed under vacuum to give life indefinitely? J. M. BEATTY.

Columbus, Ohio, July 30, 1906.

[Some of our correspondent's questions could obviously be answered offhand, but most of them require an intimate knowledge of the canning and preserving industry. The questions are here printed with the hope that some readers of this journal may be willing to impart whatever information they may have on a matter of such sanitary importance.—ED.]

The Current Supplement.

The current SUPPLEMENT, No. 1601, opens with an article on the performance of the Franklin air-cooled automobile in crossing the continent in record time. Excellent illustrations accompany the article, showing the difficulties which had to be overcome. A thorough article is that on artificial diamonds. R. Lydekker discusses instructively some rudimentary structures, illustrating his explanations with striking pictures. The colors of the sky and the solar disk are made the subject of a very clear and scientific article by Prof. G. Sagnac. The Hon. R. J. Strutt's splendid paper on the internal heat of the earth and the thickness of the earth's crust, which attracted so much attention when it was read before the British Royal Society, is published. Prof. T. J. Pond contributes an account of the Morton memorial laboratory of chemistry of Stevens Institute of Technology. Prof. E. R. Lankester's paper on the increase of knowledge in the several branches of science is continued. In this last installment he treats of the physiology of plants and animals, psychology, and Darwinism. Robert T. Lozier, well known as a designer and builder of gas engines, writes lucidly on the "Fundamental Principles of Gas Engines and Gas Producers."

It is customary, in order to obtain a leather pliant and at the same time impermeable, to apply upon the dressed side a solution of India-rubber or gutta-percha and grease in chloroform or benzine. But this method is impractical, for the chloroform and benzine rapidly evaporate, and the brush or usage soon causes the caoutchouc to disappear. Experience has proved, on the other hand, that the efficacy of the process is perfect, if the solution of caoutchouc be applied upon the *hide* side. Not only does the solution then penetrate better into the pores of the leather, but this side of the leather (the inside of the shoe), being covered with a lining, it is not subjected to the friction of the dressed side. The application of the caoutchouc solution, however, renders the surface of the leather a little wrinkled, and it is necessary to rub this surface when dry with powdered talc, which blends with the caoutchouc, thus forming a smooth surface. If, moreover, care be taken to grease the dressed side, the leather thus treated is absolutely impermeable.

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THE MARVELS OF PLANT RETARDATION.*

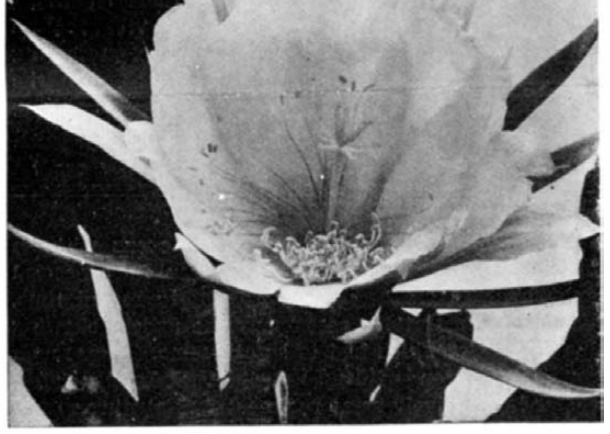
BY S. LEONARD BASTIN.

Never before in the history of the world have such striking advances been made in the realm of horticulture as has been the case during the last twenty years. Step by step, patient investigation and skillful experiment have removed those difficulties and deficiencies of which the oldtime gardener was so painfully conscious. Probably few innovations have had such a revolutionary effect as the introduction of the system of plant retardation by cold, which was first practised in England about eight years ago.

The root idea of plant retardation is so simple that it is a wonder that nobody had thought of attempting something of the kind years before the scheme was put to a practical test. It is a fact well known to everyone that in the natural world the retarding of vegetation by low temperature is of common occurrence. During late winters, when the grip of the ice king sometimes extends well into the spring season, all kinds of plant life are often held in check for weeks. That this does not in any way cause injury is very evident from the fact that directly the warm weather comes, the buds on the plants split and the tender green leaves begin to develop, none the worse for the experience. All that has taken place has been a prolonging of the winter sleep, in which all plants indulge.

As has often been the case before, mankind has taken a leaf out of nature's book. The retardation of plants as practised by the twentieth-century gardener is merely an artificial lengthening of the dormant

A Cold Storage Building in Which Plants Are Retarded. In This Building Five Million Lily-of-the-Valley Plants were Retarded in a Single Year.



A Splendid Specimen of Phyllocactus Albus Superbus.

state, although carried much farther than is ever the case under natural conditions.

It is curious that it is not known who was the discoverer of the method of plant retardation. The idea had not long been mooted, however, before an English firm of flower specialists decided to test the matter thoroughly in order to find out its commercial possibilities. It was felt that if certain plants could be kept from flowering at their natural time by means of a continuous low temperature and then blossomed quite out of their season, a most valuable addition would be made to the resources of the florist. This is what has actually been accomplished, with the result that in the case of some kinds of plants the gardener is quite independent of the seasons.

The first experiments were carried out in connection with lily of the valley. This plant is, of course, a naturally spring-flowering variety, and as it had shown itself amenable to forcing it was felt that it would be likely to prove a suitable subject for retardation. Some lily roots were placed in a refrigerator in the late autumn, and were kept there all through the winter, past the proper blooming time of the species, right until far into the summer. On a certain day the roots were properly thawed in a cool place, and then were brought out into the light and warmth. In a surprisingly short space of time the plants burst into a wealth of flower and foliage and for the first time in history lilies of the valley were on the London market in August.

As may be imagined it was not long before many other kinds of plants were tested as to their ability to stand the ordeal of retardation. It was found that nearly all the Japanese lilies, as well as such plants as azaleas, spiræas, syringas, etc., were very good subjects for the treatment and the list seems to be capable of a good deal of extension. It is strange that up to the present all attempts to retard hyacinth, tulip and narcissus bulbs have met with failure. Why this is so does not seem to be at all clear, for one would think that the plants would be more capable of standing the degree of cold than the Japanese lilies.

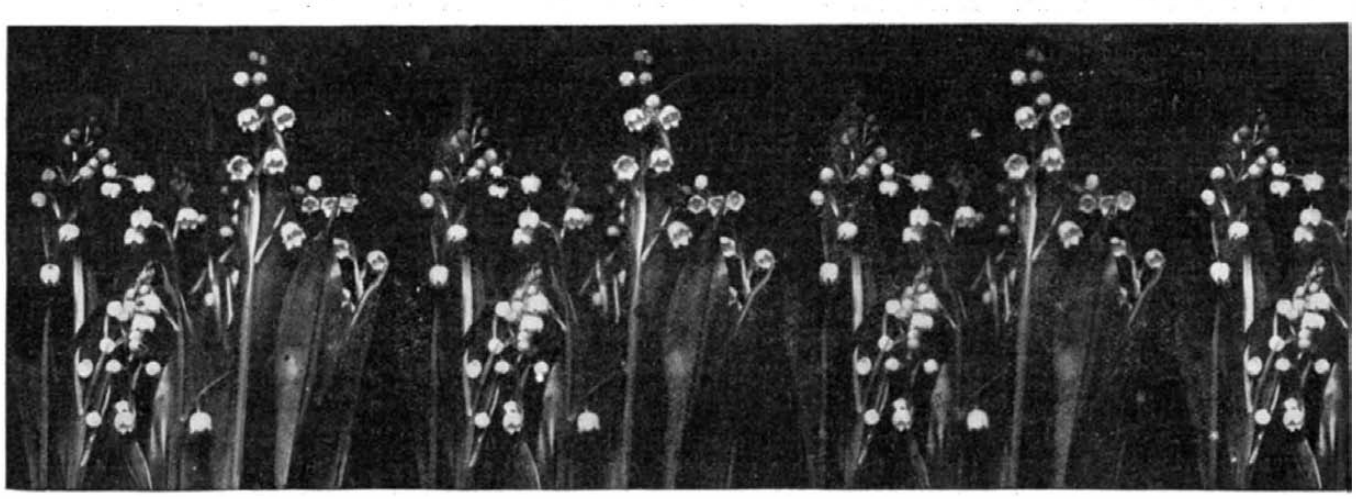
It is obvious that it is only hardy kinds of plants which could be retarded, and even with these the matter of the adjustment of the temperature is of supreme importance. Some varieties will bear only a degree of cold which is just at the point of freezing, while others do best with several degrees of frost. To find out all this requires a great deal of investigation, and the secret of the exact temperature which is most desirable for each plant is jealously guarded by firms who make a specialty of retardation.

It is an interesting experience to visit a plant-retarding establishment. By far the most prominent feature is the huge cold storage building in which the plants are stowed away. Under the care of the guide one passes the portals. In a moment one steps from the warmth and light of a summer's day into the cold bitterness of a winter's night, the darkness of which is but feebly relieved by the flickering hand lanterns. The interior of the building is divided into various chambers, and each one of these is allotted to some particular kind of plant. This is full of lily of the valley roots, the next is packed with boxes containing lilium bulbs, while again a compartment is crammed with small potted plants of azalea and spiræa. Each and all of these varieties are in a dormant condition, sleeping away their time entirely unconscious of the changing seasons in the outside world. The walls of the chambers are thickly coated with a deposit of frost crystals, and millions of these flash like diamonds in response to the rays of light from the lamp. The degree of cold is usually obtained by means of a compressed air apparatus, and the freezing current is led into the different chambers through wooden channels. In course of time these passages get choked with hoar frost, and it becomes necessary for a man to enter them and clean the accumulation away. That this is a cold job may be realized from the fact that in places the temperature is as low as twenty degrees below zero. The costume of a workman engaged in this clearing-out operation consists of what is practically an Arctic outfit. Every part of the body with the exception of a small hole for eyes and mouth must be protected with thick wool. Otherwise serious frost bites would ensue.

Retarded plants may be kept in check for eight months, or at times as long as a year, and curiously enough they do not seem to be any the worse for the treatment. Indeed, the experience seems to make them grow all the faster when they are allowed to make a start. Some varieties grow at a tremendous rate when they are brought into heat, and this is particularly noticeable in the case of lilies of the valley. The writer as an experiment tested a batch of lily roots which had been retarded just to see how fast they would grow. These were planted on a certain day and in one week had made great progress, being six inches in height. More remarkable still, in another week the plants were fully out in a splendid display of leaf and fragrant bloom. The whole process only took fourteen days from start to finish. Of course, all this means an immense saving of time to the flower grower. All kinds of retarded plants are exceedingly easy to grow and do not require any great amount of forcing. The principal point to bear in mind in their culture is that all roots must be well thawed before they are placed in a warm situation, and that the growing plants should be shaded from strong sunshine.

The Man Who Works in the Channels that Lead Cold Air Into the Chambers Wears Arctic Dress.

There is no doubt that plant retardation has a great future before it. As the system extends, the gardener will be able to turn the seasons topsy-turvy and produce flowering plants at any time of the year. Were it possible to apply this method to fruit trees it is obvious that a tremendous step would have been taken. But in this direction there lies a great difficulty. It is quite likely that an apple tree, for instance, might be kept from starting into growth in the spring and held in a latent state all summer through. Then early in the autumn the tree might be placed in a glass house, when it would almost certainly burst into flower and leaf. With the diminished power of the



Lilies of the Valley Which Bloomed Weeks After They Were Out of Season.

THE MARVELS OF PLANT RETARDATION.

*From American Homes and Gardens. Published by Munn & Co.

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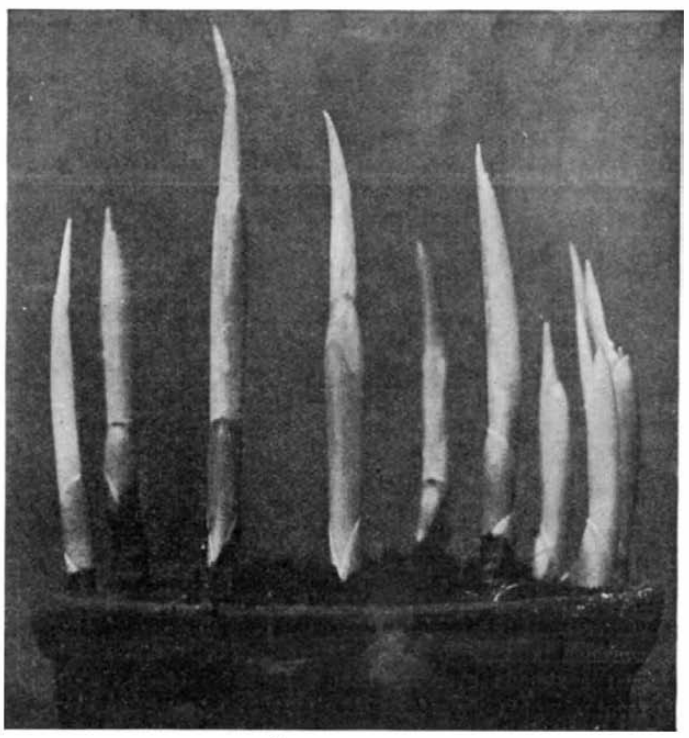
sun which is characteristic of the winter months, however, the development of fruit would be an impossibility. No amount of artificial heat would take the place of the rays from the solar orb. This applies to all fruit-bearing plants.

At the present time experiments are being actively pursued on both sides of the Atlantic to see whether it is not possible to discover some light which would have the same effect on vegetation as has the sun. Science is familiar with the composition of the solar rays to a large extent and it does not seem an unreasonable thing to seek for an artificial substitute. As a matter of fact, the rays from an acetylene lamp have been found to approximate very closely to sunlight. So much is this so that fairly well developed plants have been produced which have never known the daylight, the whole course of their existence having been spent under the influence of acetylene light. Still up to the present the experiments tend to show that there is something in sunlight which has not as yet been demonstrated by analysis; some magical influence of which human beings are conscious but cannot explain. The secret is worth finding out, for artificial sunshine in combination with plant retardation would place the gardener in a wonderful position.

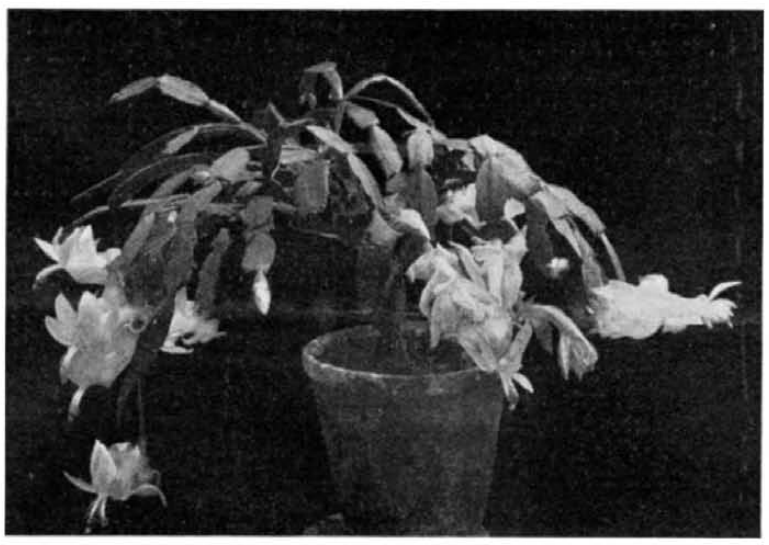


Lilies of the Valley After Retardation, Showing Their Appearance on the Seventh Day of Their Exposure to Heat.

A Revival of "Animal Magnetism"?

In 1841 Braid is held to have scientifically overthrown the claims of "animal magnetism," over which at the end of the eighteenth and beginning of the nineteenth century the civilized world was so greatly excited. He showed that the effects obtained by Mesmer and his followers (people put asleep or paralyzed, thrown into convulsions or dreams, their senses deceived, the well made sick, the ill cured, etc.) are produced, instead of by any force flowing from one human body to another, by the influence of mind upon mind—not by magnetism, but by hypnotism. Though thus scientifically discredited, however, the idea of "magnetism" has persisted in all classes of society up to the highest and most cultivated. The "magnetic" healer, claiming to be a person peculiarly "sensitive" and to have been born gifted with a mysterious power over others similar to that of the magnet over metals, has continued to flourish. Indeed, from Mesmer's time some persons have asserted that by holding their finger close to it they could deflect the magnetic needle. Even the eminent physicist Fechner claimed to have done this once, though he never could repeat the feat. But recently a well-known German university professor has apparently scientifically proved that this power really is possessed by some persons; whence the inference that, not impossibly, the ability also to influence other people by it exists. In an article on "Human Magnetism" in Ueber Land und Meer, Dr. Otto Neustätter, of Munich, says:

"Prof. Harnack, of Halle, last year demonstrated that he is able to deflect the magnetic needle by stroking quite lightly with his finger-nail the glass lid of a well-constructed compass. In many experiments he found, on the one hand, great differences in himself according to the time of day, whether he had previously rested or worked, talked or taken food. When the stomach was empty or when he had talked much, for instance, the experiment did not succeed; if he had eaten and drunk, it usually went very well. On the other hand, among many persons he found only very few who like him could perform the experiment. But these experiments were not free from objection, because they might be connected with the friction. Now, however, he has the proof that the same effect is to be reached even without friction, and that there are other proofs also of the 'magnetic' quality of certain persons. He himself could occasionally bring the needle to a deflection by simply touching the compass lid. He discovered also that the keys which he had carried for some time in his pocket, and also his key-ring, had become decidedly magnetic. Further, that in his pocket-knife the blade which he regularly used (viz., the nail-file), as well as pins that he frequently stuck into his coat, had taken on the same property. At the house of a lady, he could certify that her scissors had become so magnetic that needles clung to them in clusters.



A Fine Epiphyllum in Full Bloom.

The twenty-six scissors of her house-mates, on the other hand, were unmagnetic. One lady could deflect the magnetic needle by approaching her upper body to it. As it proved, the steel fastenings of her corset had become decidedly magnetic by wearing. Finally, he found a lady, too, who declared that she had repeatedly succeeded in attracting the magnetic needle simply by approaching her fingers. He made the experiment with this lady and a compass-needle ten centimeters long, every possible precaution being taken to exclude self-deception. The fingers, for periods of five and ten minutes, were kept approaching and withdrawing from the needle, without the anxiously expected result following. Then suddenly the fingers of the lady became cold, and at that moment the point of the needle moved toward her fingers. By further movement, they finally succeeded in deflecting the needle 20 to 25 deg. A second time, the experiment suceeded when the fingers grew cold. A third time, however, it failed."

Prof. Harnack himself declares that persons possessing magnetic qualities can produce no special effect upon others; but that, on the other hand, all the phenomena of "magnetizing," i. e., of the peculiar influencing of others' will, ideas, and health, are produced also by those who do not exhibit magnetic qualities.

As to the origin of this magnetic quality, Dr. Neustätter goes on to say that recently the physicist, Prof. Heydenweiler, of Münster, "at the instigation and with the co-operation of the nerve-physician, Dr. Adler, made experiments with the self-electrifying of the human being. In them it appeared that a fine electrometer gave a distinct indication at the moment when the person experimented upon (whose hand was in anelectric communication with it) mounted an insulator. The hand thereby showed itself to be charged with negative electricity. That, however, would have been merely a confirmation of Harnack's and others' observations; for instance, of those of Pfabb, who already in the first third of the last century had discovered that human beings are charged with electricity; or of Loewenfeld, who recently observed a gentleman and his son, from the points of whose hair and beard, and from whose finger-nails and feet, electric sparks sprang. But Heydenweiler succeeded in even finding the source of this electricity. To wit, when the person in question made muscular exertions (for example, did the knee-exercise), then the current was reversed: the hand became positively electrical. By this was proved that the charge is connected with the muscular activity. This was more clearly shown by the charge agreeing exactly with the direction of the electrical muscular currents, whose course we have exactly known since Du Bois-Reymond. Thus all at once the entire material of observation here in question is removed from the 'mysterious' sphere. For the muscle and nerve currents are something thoroughly familiar to us. Not that we know what here causes the living cells to develop electrical powers. Nor do we know what causes the saliva-cells to secrete saliva, or the liver-cells bile. But we stand here upon a field that no one will refer to the realm of the mysterious, any more than he will regard the secretion of gastric juice as a supernatural thing. To be sure, much here still remains to be investigated. It is above all very interesting that electrical currents can turn in the body into static electricity (for of that, and not of 'magnetism,' what is here insisted on is a question, though both are related to each other); that the body, which has hitherto been regarded as a good electrical conductor, can store up the electricities separately, so that the negative accumulates in the hand, the positive in the foot; that many persons have much greater ability (perhaps on account of drier or thicker skin) respectively to retain or part with this electricity, etc. But hereby this phenomenon is saved from the bewildering mazes of mysticism. And, under these circumstances, it may quite willingly be conceded that there is one or another 'magnetopath' who possesses magnetic powers. The nimbus that hitherto he has been able thereby to create for himself will be forever gone. It rests perhaps wholly merely upon a certain 'thick-skinnedness'; at all events, not upon superior soul-power — upon no special grace."

Lilium Auratum After Retardation.

Azaleas Are Good Subjects for Retardation.

THE MARVELS OF PLANT RETARDATION.

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THE MURRAY AUTOMATIC PAGE-PRINTING TELEGRAPH—ITS HISTORY AND ITS PROGRESS.

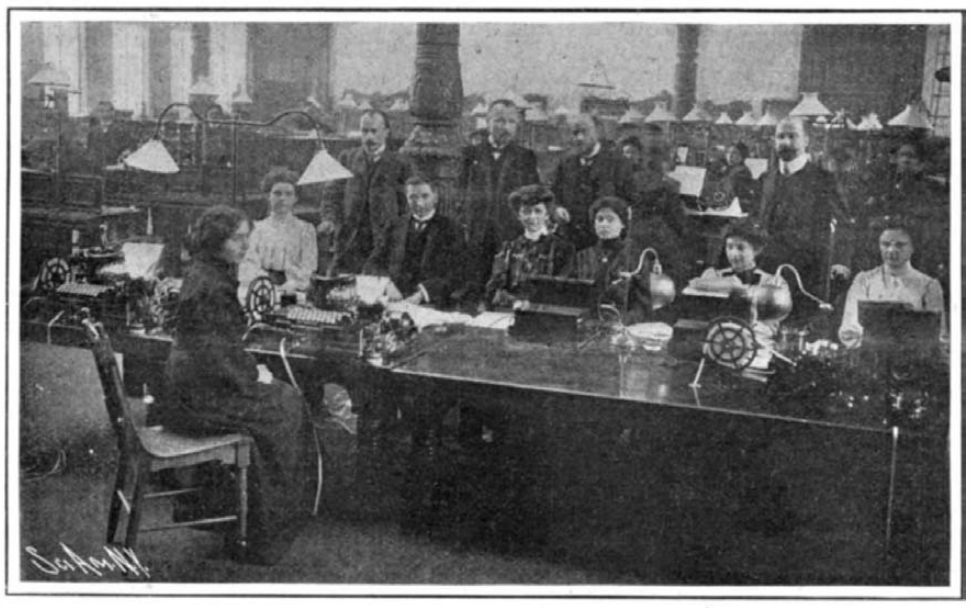
The accompanying photograph shows the Murray automatic page-printing telegraph system recently installed in the head telegraph office, St. Petersburg. The system is now working between St. Petersburg and Moscow. While the apparatus was being installed some very successful experiments were made with it on long Russian lines. In these trials from 50 to 100 per cent higher speeds were obtained with the Murray system than with the Wheatstone system under exactly the same conditions. In one case a telegraphic loop line was made up as follows: St. Petersburg-Yaroslav-Kazan-Moscow-St. Petersburg, the length of the line being 1,926 miles of iron wire with three repeating stations. The Wheatstone system got from 35 to 40 words per minute. The Murray system reached 56 words per minute. This is the first time on record that a printing telegraph has worked over such a distance as 1,900 miles even of copper wire, and in this case it was iron wire. A very successful trial was also made with the Murray system from Berlin to St. Petersburg, direct without a repeater, 1,080 miles. A speed of 70 words per minute was reached perfectly. The Murray automatic system is now working between London and Edinburgh, Berlin and Hamburg, St. Petersburg and Moscow, and sets are being made for London-Dublin, Bombay-Calcutta (1,200 miles) and Vienna-Prague. The inventor, Donald Murray, who is sitting at the table, is a New Zealander by birth, and evolved his system in Sydney, Australia, while engaged in newspaper work.

The story of the development of the Murray printing telegraph is rather curious. Most printing telegraphs have been exploited by companies, which have almost invariably lost money, often heavily. The Murray system, on the other hand, like a good mine, has paid for its own development. Mr. Murray constructed a working model of this and brought it from Sydney to New York in 1899 to have it patented by Messrs. Munn & Co. and to have it taken up by one of the typesetting machine companies, the idea at the back of the invention at that time being the construction of an automatic typesetter, something like the Monotype, but with telegraphic possibilities. When the model was unpacked at the Scientific American offices in New York it was found to have been wrecked by careless handling in transit, and inquiry showed that there was no field worth troubling about for automatic typesetting on the lines proposed. An unknown journalist in a strange city with a smashed-up model of an invention that nobody wanted was hardly the sort of combination to win success on lower Broadway. But the model was patched up, and after the necessary patents had been taken out, it was exhibited at the Astor House. The novelty of the thing attracted attention, and although there was no field for it as an automatic typesetter, its telegraphic possibilities attracted the notice of the Postal Telegraph Company, and the inventor was engaged by the company to develop it as a printing telegraph. After two years work with the Postal Company it had grown almost out of recognition and had evolved into the "Murray Automatic Page-Printing Telegraph System," and was able to transmit and print messages in page form at the rate of 100 words a minute. "The Baby," as friends jokingly called the system, was then brought by the inventor to London, where it was taken up by the British Post Office. The infant, however, was still very delicate and required most careful nursing. After a year in London a circuit equipped with the system between London and Edinburgh was started on regular telegraph traffic. It was then exhibited in Berlin, and the German government had a set constructed to work between Emden and Berlin. What the German telegraph engineers described as *Kinderkrankheiten* or ailments of childhood were, however, so numerous that both in England and Germany the system led a very precarious existence for a couple of years, and a long series of radical improvements had to be made before it could really be described as a success. In fact it is only with the last twelve months that all weaknesses have been at length eliminated. An obstacle that has delayed progress has been the difficulty of adapting the system to meet the varied requirements of different telegraph administrations. Rival systems have also made telegraph administrations slow in coming to a decision. These obstacles, however, are now disappearing, and the Murray automatic system has proved itself to be without a rival for its own special work, namely, for long telegraph lines, underground cables, and press messages.

The Murray system in the form that it has reached in its final development consists of a group of machines at each end of a telegraph line. Several operators working on perforating machines with keyboards like typewriters prepare the messages for transmission in the form of holes punched in a narrow paper tape. The paper tapes with the messages recorded on them in this way, are then run through an automatic transmitter, a small machine which sends over the telegraph line signals corresponding with the holes in the paper tape. These signals are transmitted over the line at a speed sufficiently high to permit the transmission of the messages punched by several operators over one telegraph line. At the receiving station an electrical perforating mechanism under the control of the transmitted signals makes an exact reproduction of the transmitting tape. This received tape then runs into the automatic typewriter or "printer," which prints the messages in ordinary typewriting in page form under the control of the perforated receiving tape somewhat after the fashion of a mechanical piano. The speed of the printer is now very high, not less than 150 words (900 letters) a minute, but practical considerations of durability and maintenance of the typewriter limit the speed at present to about 100 or 120 words a minute. The limit of speed in transmission of the signals over the line is in the receiving perforator which reproduces the tape at the distant station. With the improved machinery now in use it has recently been found possible to punch the received tape faultlessly at the rate of 184 words (1,104 letters) per minute. At this speed no less than ninety-two holes per second have to be punched in the paper tape successively by a single punch. A similar group of machines in the reverse order are required for transmitting messages in the opposite direction on the same wire at the same time. It was a model of the printer, at that time in a very crude form, that Mr. Murray brought with him from Sydney to New York in 1899. In New York the electrical portion of the system for perforating the tape, transmitting the signals and perforating the received tape, was evolved. At that time the printer appeared to be a sort of cross between a sewing machine and a barrel organ. An operator had to work the printer by turning a handle, and the machine was variously known as "Murray's coffee mill," and "the Australian sausage machine," but more frequently as "the Baby." In London the printer was very greatly improved. An electric motor to drive it was provided, and all the actions were made automatic, the machine stopping at the end of each line, running the typewriter carriage back, turning up to a new line, and starting again, and finally stopping at the end of each message, all under the control of the perforations in the paper tape. A very necessary improvement was a method of invisible correction of errors in the transmitting tape. With the system in its now perfected form, if an operator on one of the keyboard perforators at the sending station strikes a wrong key or perforates a wrong word, all he or she has to do is to press a back-spacing lever and a "rub-out" key once for each wrong letter. This action punches the erroneous portion of the tape full of holes so as to obliterate the wrong letter or letters. This obliteration is reproduced in the receiving tape at the distant station, but the printer is so arranged that it stops work for the moment during which the obliterated portion of the tape is passing through it. The result is that no trace of the error, not even a blank space, appears in the printed message.

The system has been in steady commercial use for about three years between London and Edinburgh, and a circuit is now being equipped with Murray apparatus between London and Dublin. For about 18 months it has been working between Hamburg and Berlin, and the St. Petersburg end of the Murray circuit recently established between St. Petersburg and Moscow is shown in the illustration. An installation of the apparatus for Calcutta-Bombay (1,200 miles) is now approaching completion and arrangements are being made for a staff of Murray experts to go out to India to install the system. A set is nearly finished for working between Vienna and Prague, and arrangements are also being made for manufacturing Murray apparatus to equip several other circuits.

It may be mentioned that Mr. Murray has been engaged by the British Post Office for a term of years to invent and develop some new printing telegraphs to suit special conditions. Mr. Murray points out that this engagement is in accordance with a tendency that has become very marked of recent years.



THE MURRAY PAGE-PRINTING TELEGRAPH USED AT ST. PETERSBURG.

Mr. Murray, the inventor, is seated at the table.

An Experiment Station for Economic Botany in Sweden.

The rational cultivation of medicinal and other economic plants for home use is receiving a timely impetus by the establishment of a botanical garden near Landskrona in Sweden. It is noted with interest that herbarium botany, plant registration, and the fabrication of new species form no feature of the station, but that the economic welfare of the small farmer and the principle of home production for home use are the considerations on which Consul Oscar Ekman made the philanthropic bequest that places the establishment on a real and permanent footing.

Sweden, like most other European countries, imports most of its medicinal herbs, even such as might be cultivated within the country itself. Technical vegetable products likewise are derived mostly from abroad, and in spite of the high protective tariffs—which, in this case, hitherto protected none but foreign dealers—no concerted action had been made toward the rational cultivation even of such plants as grow well in Sweden.

Consul Ekman, now in his ninety-fourth year, a native of Sweden and for many years closely associated with Mr. Carnegie, conceived the idea of establishing the station named Esperanza as a teaching institution where could be found such information in the shape of museum specimens, experimental fields, and preparation of raw plant products, as would be necessary for the instruction of farmers, gardeners, and others concerned with agricultural products.

Of primary interest is the culture of mint. The importance in medicine and in various manufactures of the essential oil of peppermint is so great that the market is never fully supplied, and high prices are often paid for a mediocre product. The same is true of the flowers of Chamomilla, a plant formerly cultivated in nearly every country garden; also of various pigment plants, fiber plants, and, not the least, of seeds of caraway (*Carum carvi*).

The establishment was dedicated in the early part of July. As above said, it is located near the city of Landskrona, and consists of a museum and experimental fields. The success of the work will determine its future development. Two directors have been designated, one a practical botanist, the other an apothecary. The botanical work is in the hands of Tom von Post, director of the seed control station at Upsala, author of "Lexicon Generum Chanerogamarum," who is thoroughly familiar with the status of economic botany in Sweden. Mr. Hjalmar Lindström, of Landskrona, is in charge of the technical branch of the work.

Viewed in the light of social economy, the station Esperanza represents a most interesting movement. In the northern countries more than anywhere else, the times are ripe for an energetic cultivation of small areas of land, and the very scarcity of land renders the problem of profitable crops a constant and serious question. The founder, as a practical man, has recognized this, and in his search for a useful application of his great wealth that has already benefited the national institutions of learning in Sweden as well as the cause of popular enlightenment, has struck a happy note. Botanical institutions are not scarce where scientific problems are solved, but there is a pressing need everywhere of practical work immediately useful in the small industries.

An engineer named Fisher, according to a dispatch from Berlin, Germany, has taken out a patent for wireless electrical appliances by which steam will be automatically shut off in two vessels that are approaching each other in a fog at a distance of from one-half to three-quarters of a mile.

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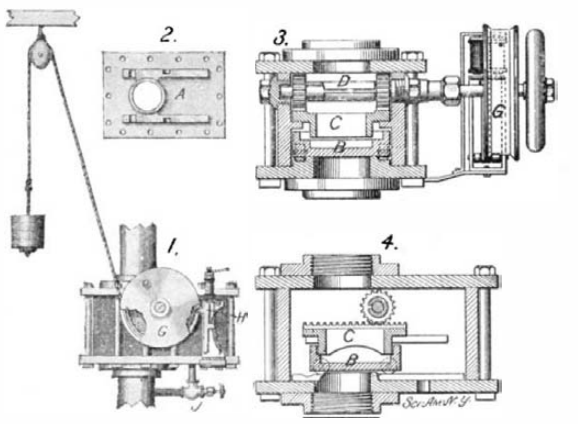
Patent Department

SAFETY STOP VALVE.

The accompanying engraving illustrates a valve provided with mechanism whereby it will automatically close when predetermined conditions take place. The invention is particularly applicable to steam pipes,

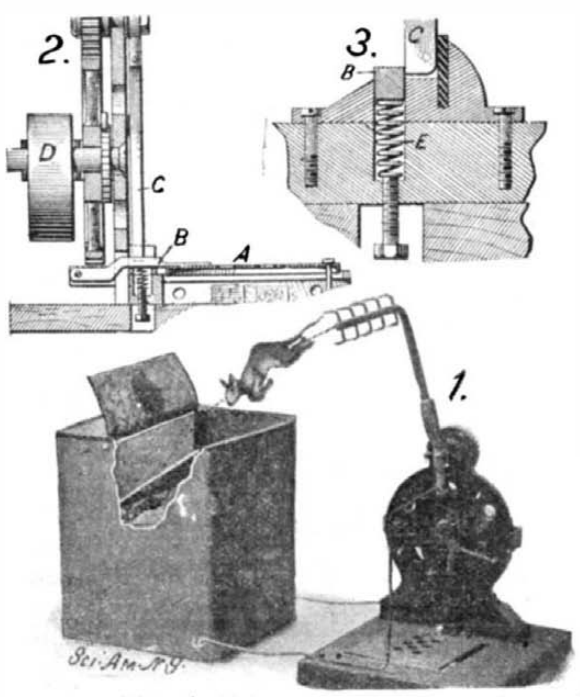


SAFETY STOP VALVE.

though it will be equally efficient for use with pipes carrying any other fluid. The device comprises a valve casing, provided with inlet and outlet pipes. The bottom of the casing consists of a plate such as is shown in Fig. 2. The plate is formed with a valve seat and a pair of tracks. The purpose of these tracks is to support the wheels of the valve, *B*, which is best shown in the section, Fig. 4. The tracks are formed with depressions to receive the wheels and permit the valve to drop onto the seat when it is directly over it. The forward wheels of the valve are broader than the rear wheels and will, therefore, pass over the depressions for the latter without sinking in. The valve, *B*, is of box form, and is open at the top to receive a downwardly extending projection of the slide, *C*. The latter is formed with a rack at each side on its upper face, and these are engaged by pinions on a shaft, *D*. The shaft carries a drum, *G*, on which a rope is adapted to be coiled. An end of the rope passes over a pulley and is attached to a weight. The weight, when it falls, turns the drum and with it the shaft and pinions, thereby moving the slide, *C*, toward the valve seat. The slide, *C*, carries the valve, *B*, with it, but does not drop with the valve when the valve seat is reached, because it is supported on rails formed on the sides of the casing. Normally the weight is prevented from falling by a trigger, *H*, which engages a notch in the periphery of the drum. The armature of an electro-magnet locks the trigger, but when the magnet is energized the armature is raised and the trigger is sprung, permitting the weight to fall and close the valve. The shaft, *D*, is provided with a handwheel by which the valve may be operated by hand. A by-pass is provided beneath the casing whereby steam may be admitted to both sides of the valve and, by thus equalizing the pressure, permit the valve to be opened easily. Mr. C. W. Nicholson, Box 399, Roslyn, Wash., has secured a patent on this improved valve.

AN IMPROVED ANIMAL TRAP.

We illustrate herewith a novel trap invented by Mr. C. T. Owens, of Hominy, Oklahoma Territory. This trap will, according to its size, be adapted to catch any undesirable animals, such as mice, rats, wolves, etc. Its chief claim to novelty lies in the fact that it not only catches and kills the animal, but also removes it to sufficient distance to prevent any interference with the subsequent operation of the trap. The trap is spring-actuated and after each operation of catching an animal it automatically resets itself for the next victim. It is thus effective for killing a large number of animals without any attendance whatever, until the actuating spring is run down. It will then merely be necessary to rewind the spring, when the device will be ready for its next series of operations. In Fig. 1 of our illustration we show a general view of Mr. Owens's rat trap in operation. The construction of the device will best be understood by reference to the detail views, of which Fig. 2 is a vertical section through the axis of the trap. The device comprises a tread, *A*, supported by a lever, *B*, which rests on a spring, *E*. The lever, *B*, serves as a detent for trigger, *C* (as best shown in the cross-section Fig. 3), which engages the lower end of a pivoted spiked arm. A heavy clock spring, *D*, acts through a series of gears to communicate a rotative tendency to the spiked arm. However, the arm is prevented from turning by the detent, *B*, engaging the trigger, *C*. In use bait is set on the tread, *A*, and when a rat, in attempting to reach the bait, presses down the tread even a slight distance, the trigger will be freed and the spiked arm will sweep rapidly around and across the tread, impaling the rat. At the same time a spring on the trigger will return the latter to its normal position, and the spring, *E*, will raise the lever, *B*, thus locking the trigger, so that when the spiked arm has made a complete turn its motion will be abruptly arrested by the trigger and the animal it carries will be slung off. To insure the death of the rat, for it might only be wounded by the spikes, a can of water is placed at a proper distance to catch it as it is slung off the trap. The can is provided with an inclined wall leading to a swinging vertical shutter through which the rat will slide into the water and be drowned.



AN IMPROVED ANIMAL TRAP.

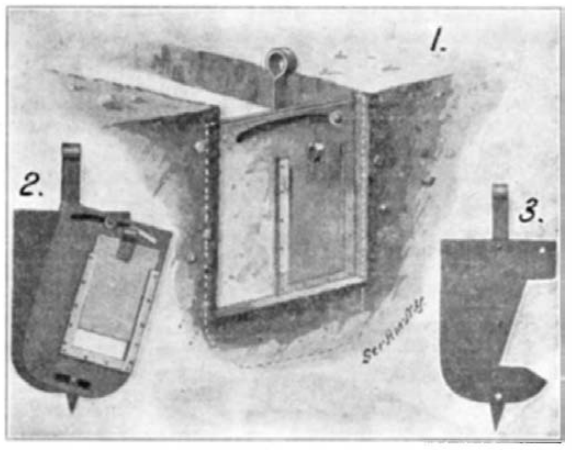
Brief Notes Concerning Inventions.

The blowing of electric-light bulbs at the present time is done by hand, and the operation is therefore slow; but a piece of machinery to do this work has been recently patented by a mechanical engineer of Toledo, Ohio. One of these machines has been experimentally constructed with four blow irons, and shows a capacity of over seven hundred bulbs per hour, but it is proposed to increase the number of blow irons to six or seven, and this will add to the output correspondingly. The necessary amount of compressed air is furnished automatically. The hot glass is thrown on the blowing irons, and as they revolve, the molds close around them, when the blowing proceeds. After the material has had a chance to cool sufficiently, the mold is opened, and the bulb dropped out into the cooling liquid. The machine is said to reduce the cost of bulb production to one-quarter the present figures. The apparatus is said to be also valuable for blowing lamp shades and similar articles.

A complete revolution has been recently made in the manner of applying gold leaf to books and other similar articles. The bookbinder at present is compelled to make use of dies in the shape of type and other forms used for ornamentation. These must be made of brass and are cut by hand, so that they are quite expensive, and a suitable assortment represents a large investment. With the use of these devices the decorative possibilities were limited to a great degree, and the process was a very tedious one. Through a recent patent there is disclosed a new process, which removes the limitations, and the application of the gold or other metal leaf is done through the medium of the pyrographic pencil, such as is at present made use of for burning wood and leather. Some slight changes are made in the point used, so that instead of the latter being maintained at a white heat it is kept at a much lower temperature, which is necessary for the success of the operation. The leaf is taken from the book in which it is sold by causing it to adhere to a piece of paraffin paper. Thus it is transferred to the point of application with the paraffin paper on top. The heated point is then passed over the latter with a slight pressure, and upon removal of the paper the leaf will be found firmly fixed to the article as desired. In this manner it will be possible to make a reproduction of a signature or certain designs, which could not be accomplished by the old process.

A PORTABLE HEAD GATE.

A simple portable head gate has recently been invented for use in open ditches and laterals which can be adjusted to any shape or size of ditch within predetermined dimensions. The head gate is provided with a waste gate that will allow any water to pass that may be needed further down the lateral. The waste gate is so located that no water passing therethrough will wash around the main gate. The device comprises two plates, one of which is movable on the other. The relatively fixed gate is shown in detail in Fig. 3. One side of the plate is cut away to provide an opening for the waste flow. The plate is mounted on a post whose pointed end projects below the lower edge of the plate. The second, or movable plate, is of the same general form as the first one without being cut away at the side. The movable plate is secured to the fixed one by bolts in the latter which pass through slots at the top and bottom of the former. The upper slot is quite long and is curved to permit the plate to be swung on the lower bolt as a center. Owing to this slotted connection, the plate can be adjusted either by prying it or moving it bodily sideways to adapt the head gate for any desired form or size of ditch within limits.

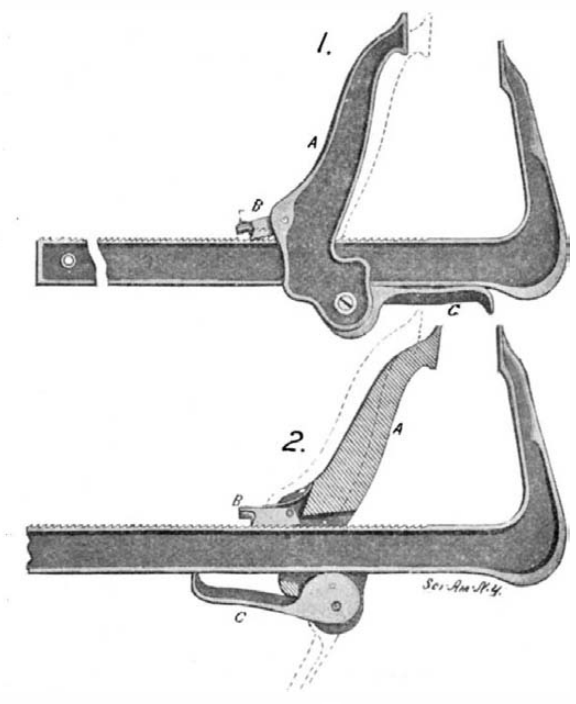


A PORTABLE HEAD GATE.

The movable plate is provided with an opening which is normally closed by a gate adapted to slide in ways on the plate. The gate serves as a waste gate and is preferably placed at one side of the center so that when the water passes through the opening it will not have a tendency to work around the gate proper and disturb its position. The inventor of this improved head gate is Mr. U. F. McBurney, Boise, Idaho.

WOODWORKER'S CLAMP.

An improved clamp, more particularly designed for the use of carpenters, cabinetmakers, and other woodworkers, has recently been invented by Mr. Emil Hillebrandt, of 91 Cottage Street, Buffalo, N. Y. This clamp is arranged to permit quick and convenient adjustment of the jaws, to securely clamp pieces of wood that are to be glued together. The clamp comprises a shank terminating at one end in a fixed jaw. Mounted to slide on the shank is a movable jaw, *A*. Mounted on this movable jaw is a pawl, *B*. The latter is formed with ratchet teeth which are adapted to mesh with teeth on the shank when the jaw, *A*, is locked in position. The pawl is normally pressed by a spring against the shank, but is provided with a handle whereby it may be withdrawn whenever desired. Bearing against the opposite side of the shank is a cam, *C*, which is journaled in the body portion of the jaw, *A*. In use, the work to be clamped is placed against the fixed jaw, and then with a cam turned upward, as shown in Fig. 1, the movable jaw may be pressed snugly up against the work, the pawl, *B*, moving up idly with the jaw. After the jaw has been adjusted it is locked by moving down the cam lever, *C*, to the position shown in Fig. 2. It will be noticed that the cam draws the jaw, *A*, bodily toward the shank, but that it moves on the toothed pawl as a fulcrum and that as this is lower than the point where the cam engages the shank, the jaw is swung upward and into closer engagement with the work. To release the device the cam lever is swung up and the pawl drawn out of engagement with the teeth on the shank, as shown by dotted lines in Fig. 1.



WOODWORKER'S CLAMP.

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Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8329.—Wanted, name and address of the manufacturer of an American stenographic machine.

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Inquiry No. 8336.—Wanted, addresses of manufacturers and jobbers supplying mail order houses.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

COMB.—CHARLOTTE J. SMITH, New York, N. Y. The invention relates to combs such as ladies wear in their hair; and the object of the improvement is to produce a comb of this class which is constructed so as to prevent it from becoming dislodged. A further object is to construct the comb so that when in use it will present substantially the appearance of an ordinary comb.

CLOSURE FOR GARMENTS.—H. C. STANLEY, New York, N. Y. The object of this invention is to provide a novel closing device for women's garments, such as the closure for a shirt-waist, body of a dress, or the placket of a dress-skirt, which will be simple, neat in appearance, and convenient in use, and will dispense with the employment of buttons or the like.

Machines and Mechanical Devices.

ROCK-DRILL.—J. E. SALES, Wrangell, Alaska. The improvement pertains to drills, and especially to those adapted for operating upon rock and like substances. Its principal objects are to provide such an apparatus which may be readily positioned and efficiently operated with a minimum number of attendants.

Pertaining to Recreation.

GAME APPARATUS.—R. D. MARTIN, Havana, Cuba. The invention relates to game apparatus in which a ball is caused to circle around a post with a view to reach different counting-points on the base. The object is to provide a game apparatus arranged to afford amusement and to require considerable skill in successfully playing the game.

Pertaining to Vehicles.

VEHICLE.—G. FITZGERALD, Monroe, N. Y. This invention has reference to surreys and similar road-vehicles having spring-supported bodies; and its object is to provide certain new and useful improvements in vehicles, whereby the brake can be forcibly applied without danger of unduly shifting the vehicle-body lengthwise.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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AND EACH BEARING THAT DATE

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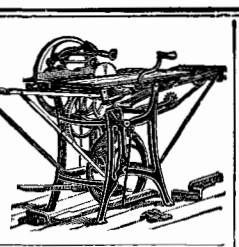

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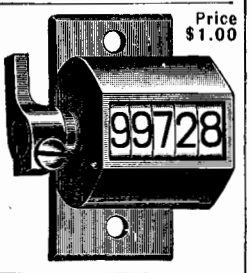

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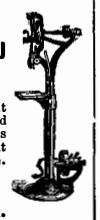

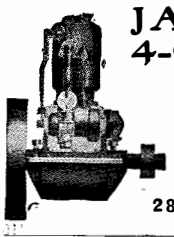

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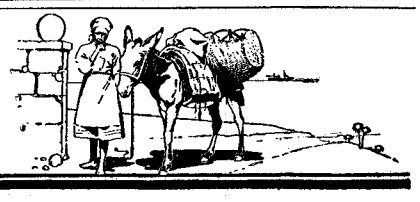

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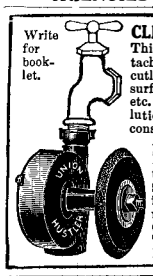

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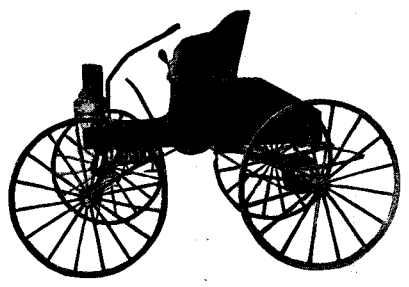

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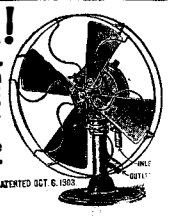

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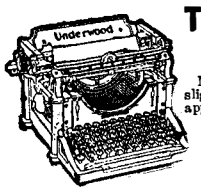

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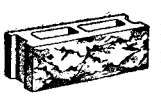

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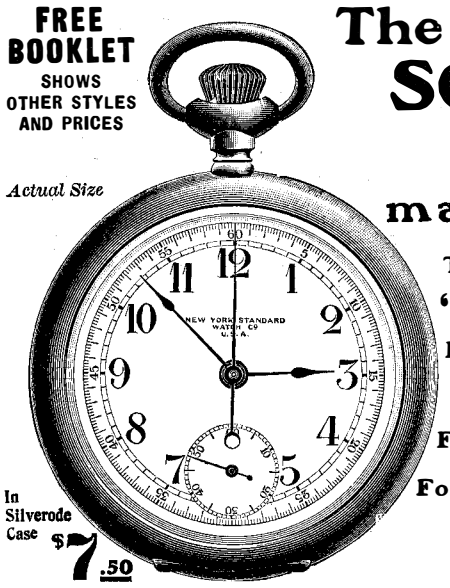

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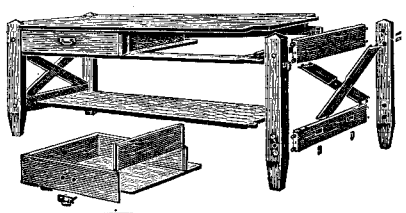

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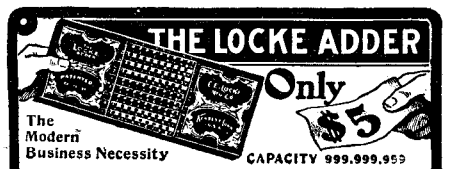

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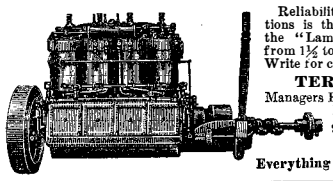

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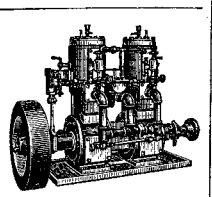

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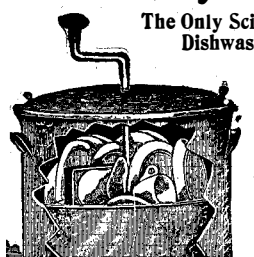

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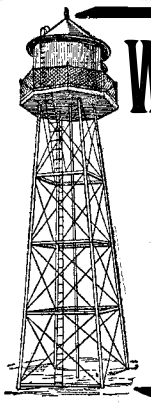

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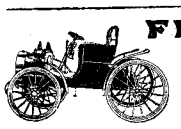

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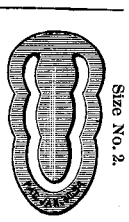

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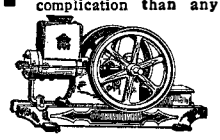

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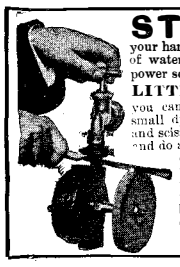

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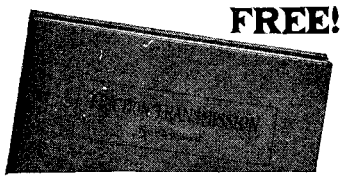

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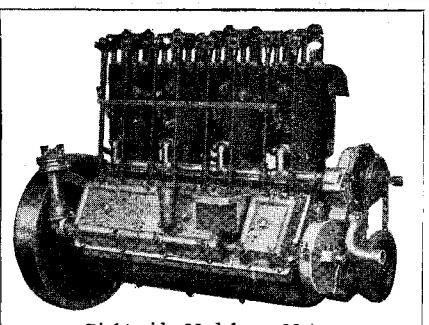

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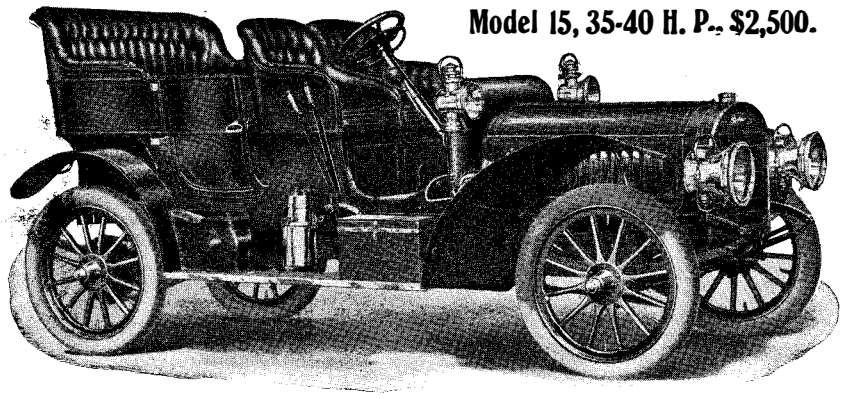

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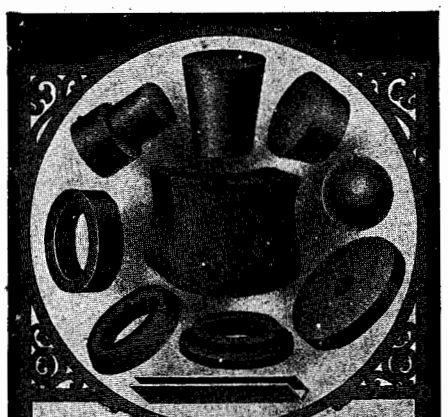

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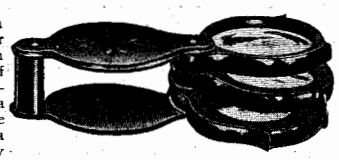

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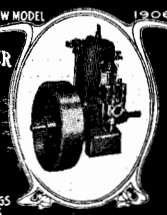

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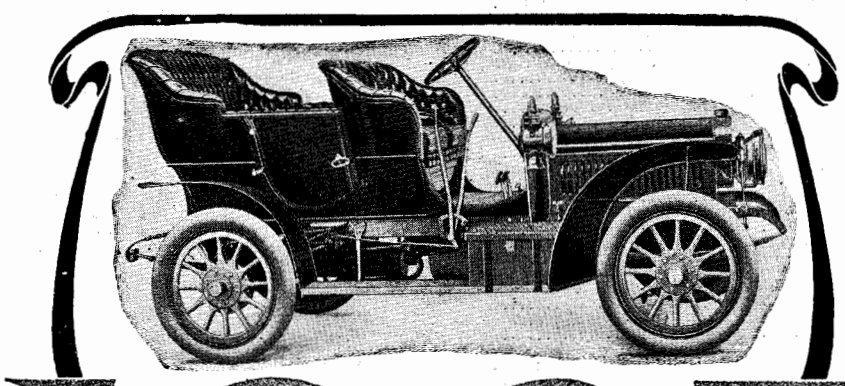

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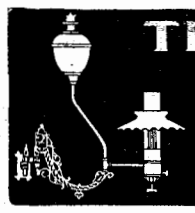

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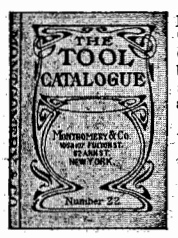

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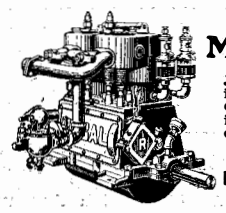

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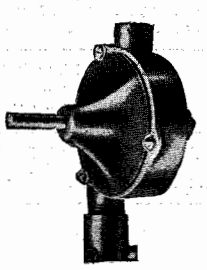

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1-4 Actual Horse Power

under 30 lbs. water pressure (the ordinary city pressure.)

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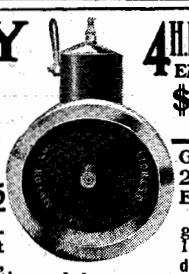

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